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INVESTIGATING THE ENVIRONMENTAL KUZNETS CURVE OF CONSUMPTION FOR DEVELOPING AND DEVELOPED COUNTRIES

A study of Albania and Sweden

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ABSTRACT OF
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Summary

The aim of this research was to investigate the long-run relationship between economic growth and environmental quality in Sweden and Albania using the environmental Kuznets curve (EKC) hypothesis. This was done through empirical research using secondary data for Gross domestic product (GDP) per capita, ecological footprint (EF) and trade openness (EX) which were run through both a regression and an Autoregressive Distributed Lag (ARDL) analysis.

Objectives

I) To investigate the individual EKCs for Sweden and Albania and their respective turning points.

II) To discover a potential delinking of economic growth and environmental quality in Sweden and Albania.

Conclusions

I) There was no evidence for an EKC for Sweden, and therefore no turning point was found using the dataset from 1984 to 2012. In other words, there was no decoupling between economic growth and environmental quality.

II) An EKC exists for Albania in terms of the relationship between income per capita and the EF. The turning point was around $1808.6, which meant that Albania has already decoupled their economic growth from environmental quality.

Key words: environmental Kuznets curve (EKC), ecological footprint (EF), sustainability, environment, developed countries, developing countries, economic growth, trade openness.

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1. INTRODUCTION

According to a 2016 press release from The World Bank, environmental disasters costs approximately $520 billion every year and forces 26 million people into poverty. Although the true cost of climate change for the future is unknown, the Stern Review (2007) estimated that the cost of these disasters could grow up to 20% of Gross domestic product (GDP) or higher. It is therefore vital for countries to collaborate and create effective environmental policies to govern human activities in order to limit our impact on the global environment. Moreover, the problem is that the poorest countries and populations who are the least equipped to handle these disasters will be the most affected even though “they have contributed least to the causes of climate change” (Stern Review, 2007:7). Hence, it creates a discussion regarding the question of responsibility. The question is about whether developed countries should take a more active role in combating environmental issues by helping developing countries, and if developing countries may be justified in focusing on their economic growth at the cost of the environment. This is important as the effectiveness of environmental policies will be dependent on creating the appropriate solutions for the source of the problem.

The aim of this thesis is therefore to examine the differences in how the economic growth in developed and developing countries affects the global environmental quality. More specifically, this thesis looks at Sweden as a developed county and Albania as a developing country to facilitate a discussion around accountability and effective environmental policies. This will be achieved in five main sections. Firstly, this thesis aims to facilitate a background for the research and to outline the focus and scope in order to establish the context for the research. Secondly, it intends to critically evaluate the existing literature on the relationship between growth and the environment. Thirdly, it scrutinizes the economic model and data to create meaningful explanations. Fourthly, an analysis of the data will be done. Finally, a discussion will be presented regarding the findings, implications, limitations of research and suggestions for further research. The thesis will end with a summary of the results and a conclusion will be drawn regarding the research.

1.1 Background and research problem

The change in climate can be attributed to demographic developments, urbanization and economic growth (Field and Field, 2016). Firstly, population growth as a result of demographic development will increase consumption of natural resources and land use. Secondly, urbanization contributes to increased concentration of pollutants in specific areas which might contribute to a worsening effect of climate in these areas. Lastly, although economic growth results in technological advancement, which could potentially decouple environmental pressures from economic growth, it often leads to a negative environmental impact due to the increased use of natural resources. Hence, there is a clear trade-off between economic growth and environmental quality. In summary, these changes will inevitably change the consumption patterns due to increased demands on the environment which again puts pressure on biodiversity and the ecosystem.

In the early 1990s, a new view on the relationship between economic growth and the environment emerged through the environmental Kuznets curve (EKC). This theory states that economic growth will eventually improve the environment after a certain point. This theory has been shown true for specific local pollutants such as sulfur dioxide (SO_2) and carbon monoxide (CO) (Shafik and Bandyopadyay, 1992; Selden and Song, 1994). However, the results for global environmental indicators such as carbon dioxide (CO_2) and the Ecological Footprint (EF) remains unclear (Caviglia-Harris, Chamber and Kahn, 2009; Choi, Cho and Heshmati, 2010; Mrabet and Alsamara, 2016). While the EKC has been widely used to explain how economic growth can potentially improve environmental quality, the issue is that many of these studies have disregarded the consumption based aspects of the economy. For instance, Japan is a country which imports most of its raw materials which would then mean that they are exporting environmental impacts on the countries with which they trade (Herendeen, 1994). In other words, although economic growth has shown to relate to improved environmental quality, most of the developed world has already outsourced their “dirty industries” to developing countries with lower labor costs. Hence, it could lead to a wrong representation of how economic growth has improved environmental quality and it is therefore necessary to understand and consider the impact of consumption patterns on the environment. In short, it is necessary to distinguish between overall improvement of the environment and a shift of emission from one country to another.

1.2 Relevance and scope of the paper

Considering the challenges with climate change and global warming, this thesis becomes increasingly important as we need to understand the consequences of our decisions and help facilitate a discussion around the topic of accountability and responsibilities of countries in the developed world. Specifically, this thesis will focus on the juxtaposition between developed and developing countries in Europe. However, the scope of this paper is limited to the impact of consumption as a response to economic growth, and its impact on environmental quality in Sweden and Albania. This is mainly due to the limited data available from the Global Footprint Network. Hence, this thesis chose to focus the research on two countries to represent different income levels. Sweden and Albania were specifically chosen due to the contrasting characteristics in terms of level of development and ranking in environmental friendliness. Sweden, a developed country and member of the European Union (EU), has been consistently in the top regarding environmentally friendly policies, while Albania is still a developing country with limited resources and in the process of becoming an EU member. These differences are reflected in their economic growth and further investigated in terms of their respective environmental footprints.

1.3 Research questions, objectives and hypotheses

The purpose of this thesis is to examine the impact of economic growth on environmental quality in developed and developing countries in Europe. Thus, this thesis tries to answer the following research question:

How does consumption in developed and developing countries affect the global environmental quality?

More specifically, it intends to use Sweden and Albania as representatives for developed and developing countries in the period from 1984 to 2012. In short, this thesis focuses on the research objectives derived from these questions:

I) To investigate the individual EKCs for Sweden and Albania and their respective turning points.

II) To discover a potential delinking of economic growth and environmental quality in Sweden and Albania.

From the objectives, 2 research hypotheses have been developed:

Hypothesis 1: There is an observable inverted U-shaped curve between income per capita and the EF in Sweden. In short, after a certain income level, economic growth is associated with a decline in the EF.

Hypothesis 2: There is not an observable inverted U-shape curve between income per capita and the EF in Albania. In other words, Albania has not been able to reach a turning point yet, but it is approaching its turning point as the economy grows.

1.4 Definitions and explanations of key concepts

This section aims to clarify the key concepts and definitions that will be referred to throughout this thesis.

1.4.1 Environmental Kuznets curve (EKC)

The environmental Kuznets curve (EKC) is defined by Stern (2004) as "a hypothesized relationship between various indicators of environmental degradation and income per capita" (p.1). It follows an inverted U-shaped curve where a country first starts to increase its pollution as the economy grows, but the pollution will gradually increase at a decreasing rate until the turning point is reached. At this point, further economic growth will result in a lowered environmental degradation.

1.4.2 Consumption

For this paper, consumption means how much land area, sea area and biocapacity required to produce the amount of goods and services used by the population in the country. In other words, we look for the impact of human activities on the natural land.

Since increased production is usually accompanied by economic growth, consumption refers to how much a country produce specific goods or service as a response to increased economic growth.

1.4.3 Environmental quality

Per Field & Field (2016) environmental quality is the "term used to refer broadly to the state of the natural environment" (p.30). In this case, environmental quality is measured by the EF which tells us the level of damage done on the natural environment. In short, good environmental quality is reflected in a low EF score. Hence, in this paper environmental quality is interchangeably used by the EF.

The footprint measures "the impact of human activities measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated" (panda.org). In other words, it measures the necessary natural resources a country consumes to support their respective economies.

1.4.4 Economic development

Sweden and Albania are separated into two groups: high income and lower middle income. In this case, high income is synonymous with a developed economy based the historical classification by the World Bank. Similarly, lower middle income is synonymous with a developing economy based on the historical country classification by the World Bank.

1.5 Acronyms, abbreviations and units

ADF	Augmented Dickey Fuller
AIC	Akaike information criterion
ARDL	Autoregressive-Distributed Lag
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CUSUM	Cumulative sum
CUSUMSQ	Cumulative sum of squares

EF	Ecological Footprint
EKC	Environmental Kuznets Curve
EU	European Union
GDP	Gross Domestic Product
gha	global hectares
NO_X	Nitrogen Oxide
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
SC	Schwarz information criterion
SO_2	Sulfur Dioxide
SPM	Suspended Particulate Matter
UN	United Nations
VAR	Vector Autoregressive

2. LITERATURE REVIEW

The pursuit of economic growth will be at the cost of the environment due to the trade-off that exists between economic growth and environmental quality (Och, 2017). In the last two decades, this relationship has been a topic of considerable debate, and research has pointed towards an inverted U-shaped relationship between economic development and environmental quality (Chowdhury, 2012). As Grossman and Krueger (1995: 369) explain, economic growth might lead to “an initial phase of deterioration followed by a subsequent phase of improvement” for suspended particulate matter (SPM) and SO_2. This supports an earlier study by Selden and Song (1994) which found evidence for the inverted U-shaped relationship between nitrogen oxide (NO_x) and CO to GDP per capita. Nevertheless, the literature regarding the relationship between economic growth and the environment remains mixed with diverging viewpoints. In fact, a reasonable proportion of the literature has found little evidence of the EKC (Caviglia-Harris et al., 2009; Mrabet and Alsamara, 2016). It seems that the divergent results are dependent on the methodologies used for analysis, and the indicator used for environmental quality as they often exclude consumption as a factor for pollution. This can be reflected in the majority of research on EKC in terms of the focus on localized emissions as the indicator for environmental quality. As the world becomes more globalized with trade playing an essential role for economic growth, the impact of consumption becomes an integral part of the environment. Consequently, more comprehensive research should include variables that can mirror the consumption rate of a country, such as the EF.

Since this paper intends to explore the impact of consumption on environmental quality between developed and developing countries through the EKC model, it is important to explore the existing literature on both variables: environmental quality and level of income. The purpose of this review is to give a brief overview of EKC literature and to justify the use of EF as an environmental indicator. Hence, the review will use a traditional framework with a narrowed and dialectical structure divided into three main sections. Firstly, it introduces the background and theoretical framework of EKC. Secondly, it presents the main critiques of the EKC theory. Thirdly, it aims to explain the reasoning and justification for the use of EF as the proxy for environmental quality. The review will end with a conceptual framework which will illustrate the direction of research and its position in current literature on the topic.

2.1 Background and theoretical framework of the EKC

In 1987, the Brundtland Commission questioned the “environment’s ability to meet present and future needs”, thus drawing attention to the unsustainable trend between economic development and the environment (UN, 1987:41). In the years that followed, many economists have debated the validity of this relationship. The discussion regarding the environment and economic growth can be divided into two main schools of thought. On the one hand, it has been argued that the race for growth has depleted natural resources and increased the concentration of pollutants at a rate which exceeds the carrying capacity of our biosphere. This in turn would result in immiserizing growth meaning that overall welfare and the environment would be in a decline due to economic growth (Meadows, Meadows, Randers and Behrens, 1972). On the other hand, it is stated that environmental quality will improve with economic growth (Beckerman, 1992; Bartlett, 1994). For instance, Beckerman (1992), as cited in Rothman (1998), mentions that the evidence has shown that in the long run, there is a correlation between how we adopt protection measures and the growth of our economy. Hence, he suggests that “the surest way to improve your environment is to become rich” (ibid:178). A less rigid claim is presented by the EKC hypothesis which states that the relationship is not fixed, but changed depending on the level of income at which the demand for better environment occurs (Shafik and Bandyopadhyay, 1992; Grossman and Krueger, 1995).

The EKC theory posits an inverted U-shape relationship between economic growth measured by GDP per capita and environmental quality represented by the level of pollution. This is illustrated in Figure 1. The results of Grossman and Krueger (1991) were insufficient for the claim that every indicator would revert to the inverted U-shaped pattern. However, the authors were also unable to find sufficient evidence for a detrimental relationship between economic growth and environmental quality. In fact, the results showed that there is an initial period of rising pollution, followed by a period of reduced pollution after they had reached the peak or turning point around $8000 per capita. In short, in the early stages, a country is focused on improving GDP per capita at the cost of the environment. Once it becomes more industrialized, pollution will increase at a decreasing rate until it reaches a turning point. Finally, growth beyond the turning point might improve the environmental quality at an increasing rate. In other words, during low income levels, environmental quality decreases with economic growth, but as it grows beyond the turning point environmental quality improves (Winslow, 2002). This is supported by several research papers. For instance, Zambrano-Monserrate, Valverde-Bajana, Aguilar-Bohorquez and Mendoza-Jimenez (2016) found that CO_2 emissions increased as the economy of Brazil grew, but that the emissions started to decrease once income rose to a certain threshold. In short, the EKC research infer that the environment is a luxury good and desired at higher levels of income while ignored at lower levels of income.

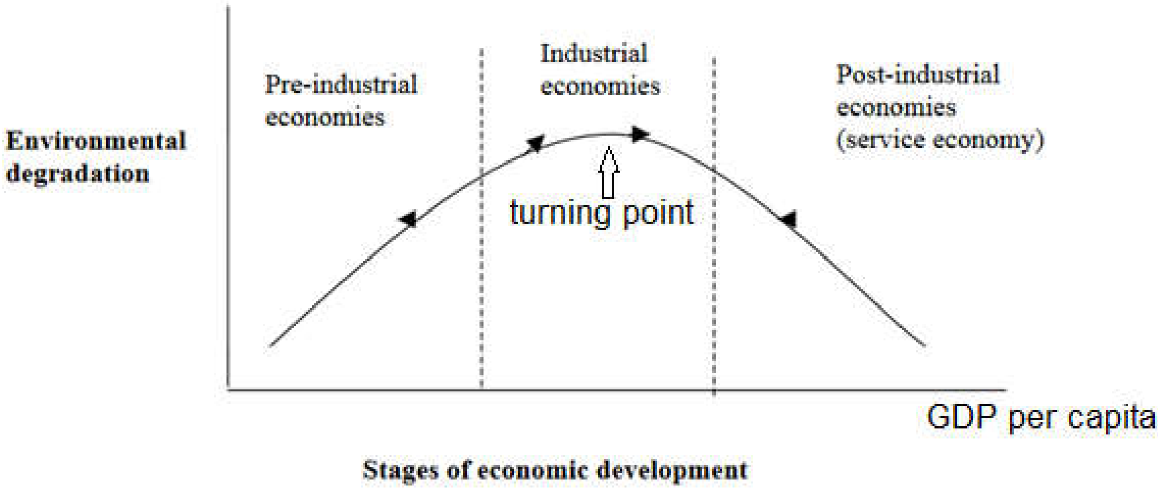

Figure 1: Stages of economic development adapted from Panayotou (2003)

The theoretical framework can be more explicitly explained by the changes in preferences, structure and technology.

1. **Preference Change**: Income elasticity regarding the demand for a clean environment has been cited as a reason for the existence of the EKC. Since the environment can be characterized as a luxury good, increased income might change the preferences of the consumers regarding the environment. Some researchers have discussed the shape of the EKC in terms of changes in demand for cleaner environment as income increases (Selden and Song 1994; Baldwin 1995). In other words, after a certain level of income, consumers place greater importance on a clean environment. This might pressure authorities to proceed with institutional measures to combat the problem (Bo, 2011).

2. **Structural change**: Panayotou (1993:11) mentions that a country will “embark on rapid industrialization” for growth in the beginning stages, which “tends to shift

towards dirtier fuels". As shown in Figure 1, pollution will increase as the country develops its economy due to reliance on primary and secondary sectors which are relatively resource heavy. Moreover, these industries are often inefficient and primitive due to lack of proper technology. Once an economy has reached its turning point, a certain level of advancement has been made and the country, ideally, moves on to the tertiary or service sector which is less resource intensive (ibid).

3. **Technical change**: At a later stage in the development of the country, environmental laws might be tightened and abatement costs increased because of the changes in preferences (Dinda, 2004). Hence, firms might be incentivized to replace old processes with new technologies as it pollutes less and has greater ability to process resources, which in turn means lowered costs in the long-run. This is explained by Perman and Stern (2003) which mentions that the state of technology will be able to change the production efficiency by using less material per unit of output, and thus pollute less per unit of output.

2.2 Key limitations of the EKC theory

There are concerns regarding the adoption of the EKC theory. The opponents of the EKC hypothesis believe that the evidence for the EKC is misleading and attributes it to "snapshots that mask a long-run "race to the bottom"" (Dasgupta, Susmita, Laplante, Beniot, Wang, Hua, Wheeler and David, 2002:148). In addition, the EKC has been criticized for not accounting for all environmental indicators (Caviglia-Harris et al., 2009). However, the research behind this theory has not claimed that it should be applicable to all circumstances or for all environmental indicators. Hence, more constructive critiques come from authors who challenge the findings in terms of the possibility of the pollution haven hypothesis as the EKC does not take trade effects into account, and the validity of the U-shape relationship through findings of N-shaped relationships. Additionally, the empirical evidence of EKC remains mixed and several authors have pointed out the shortcomings regarding the methodologies (Stern, 2002; Müller-Fürstenberger, and Wagnerb, 2007). This questions the strength and validity of the evidence found in earlier EKC literature.

2.2.1 The effect of pollution havens

One key limitation within EKC literature is that international trade is not accounted for, which means that the decrease in pollution could be a factor of pollution havens rather than abatement. As countries become wealthier, so do their abilities to shift environmental degradation associated with consumption to poorer countries. In other words, they export their pollution thereby producing fewer emissions as the production has shifted outside their borders. This means that environmental improvement found in earlier research could be attributed to the shift of the environmental burden to less developed countries, and that economic growth has an "overall negative impact on environmental quality" (Winslow, 2002:7-8). In short, although there is a link between economic growth and environmental quality, there is an element of uncertainty regarding how much economic growth and technological advances actually improve environmental quality. To summarize, if the EKC happens only due to an emission transfer, the world as a whole is not better off as the problem is still present. It is therefore important to distinguish between absolute and relative environmental quality.

As Suri and Chapman (1998) argue, proof of EKC can be attributed to the fact that countries start to import goods that are heavy emitters instead of producing them within their borders. In other words, the environmental problem is transferred from one country to another. The issue occurs when current developing countries try to export their own emission process because, in the end, these goods will need to be produced somewhere. Moreover, according to Cole and Elliott (2003) some researchers have found that the relationship between pollution intensity within developing countries was higher during the periods when the environmental regulations of the Organisation for Economic Co-operation and Development (OECD) were more stringent. However, other authors were unable to find a significant relationship between domestic environmental regulations and increased trade of harmful products from abroad (Jaffe, Peterson, Portney and Stavins,1995; Aşıcı and Acar, 2016).

In addition, the effect of pollution havens on EKC has been found to have smaller significance than other explanatory variables (Cole, 2004). For instance, Nahman and Antrobus (2005) found that the dirty leather industry between South Africa and its trading partners, the US and the UK, supported the pollution haven hypothesis, but that the industry was not a significant part of trade between these countries. Moreover, the authors also found that the relationship existed for two clean industries “clothing and textiles” and “fabricated metal products”, which they believe “casts doubt” on this hypothesis (ibid: 812). In short, this might suggest that the pollution haven theory might not be as important as previously thought, but rather that EKC could be explained by a general shift in production industry from one country to another.

2.2.2 The N-shaped relationship

There is also a question of validity regarding the inverted U-shaped relationship between economic growth and the environment. This is because researchers have found N-shaped relationships which indicate a positive connection (Shafik, 1994; Martínez-Zarzoso and Bengochea-Morancho, 2004; Fodha and Zaghdoud, 2010; Cho, Almas and Yongsung, 2011). The N-shaped curve shown in Figure 2 illustrates how, after a certain point, the pollution will increase with the additional increase in income. However, Mazzanti, Montini and Zoboli, (2007) found that this relationship is greatly dependent on the emissions that are considered, particularly in the manufacturing industry. This supports earlier research by de Bruyn, van den Bergh and Opschoor (1998) which suggested that, for some countries, the inverted U-shape cannot be sustained over a long period. It seems that the inverted U-shape only exists at the initial stage, but might develop into an N-shaped curve. However, the literature on this shape is not extensive. As a result, it might not be a weighty critique for EKC although the interpretation of EKC needs to be evaluated with caution.

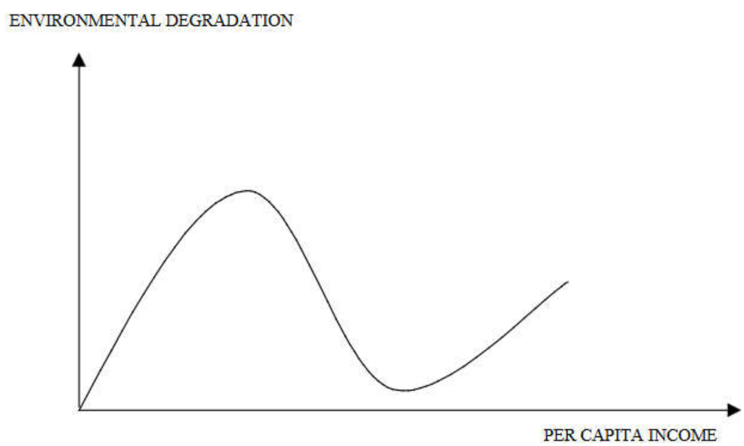

Figure 2: N-shaped (cubic) curve (Borghesi, 1996:26)

2.2.3 The divergent nature of the results

The conclusions regarding the EKC are often divergent in nature. This divergence might be explained by the different approaches and focal points the authors take. For instance, some authors use concentration of emissions as an environmental indicator whereas others focus on the ambient levels of pollution. Moreover, the time period studied and the sample sizes might also distort the results. As table 1 shows, there are differences in results between the different pollutants ranging from $2000 to $11 217. However, there are also significant differences within the environmental indicators studied. It seems that the results are also dependent on the sample of countries included in the studies and the time period studied. Although an error margin should be allowed as the turning points are not always adjusted for inflation.

Another inference for the diverging results could be that the positive results for the EKC is credited to the focus on local pollutants such as air pollution (Deacon and Norman, 2006; Merlevede, Verbeke and Clercq, 2006), water pollution (Paudel, Bhandari and Johnson, 2005; Thompson, 2012) and deforestation (Culas, 2007). However, none of these environmental indicators are effective in regard to taking consumption into account as they are only measuring pollution on the local level. Furthermore, research regarding global pollutants such as CO_2 has given negative, or at best, mixed results (Martínez-Zarzoso and Bengochea-Morancho, 2004; Galeotti, Manera and Lanza, 2006; Jalil and Mahu, 2009). It can then be inferred that the angle and methodology of the research will have a substantial impact on the results. Similarly, Caviglia-Harris et al. (2009) point out the limitations of having a ”singular focus on one (or a small group) pollutants” as measure for total environmental quality. This is a very narrowed view of the environment, which might not be enough to give an indication of the trend between income and the environment.

Additionally, the validity of EKC comes into question when there is evidence that some developing countries are able to outperform their developed counterparts (Stern, 2004). This contradicts with the theory of the EKC which claims that income level is tantamount to an improved environment after a certain turning point. Furthermore, it raises the question of whether or not the EKC has to be assessed at an individual level, and if it renders comparisons between countries redundant.

Table 1: Turning point for EKC in different studies

Author(s)	Time Period and Samples	Environmental Indicator(s)	Turning point in USD
Shafik and Bandyopadyay (1992)	**1960 – 1990** 149 Countries	SO_2, SPM	**SO_2** - \$3670 **SPM** - \$3280
Panayotou (1993)	**1985 - 1991** 68 Countries (deforestation) 54 Countries (air pollution)	Deforestation, SO_2, SPM, NO_x	**Deforestation:** \$800 - \$1200 **Emissions:** \$3000 - \$5500
Selden and Song (1994)	**1973-1984** 30 Countries	CO, SO_2, SPM, NO_x	**CO** - \$ 5963 **SO_2** - \$8709 **SPM** - \$10 289 **NO_x** - \$11 217

2.2.4 Weak methodology and significance

The research on EKC has also been questioned for its weak methodological approach. It is stated that the analysis of EKC is not robust because of the limitations to empirical implementation of descriptive statistics. As Stern (2004) states, the majority of EKC literature have used weak econometric models with "flimsy statistical foundation" (ibid:1419). Moreover, he groups the econometric critiques into "four main categories: heteroskedasticity, simultaneity, omitted variables bias, and cointegration issues." (ibid:1429). Similarly, Dietz, Rosa and York (2012) have commented on the oversimplification of the complex relationships through the narrow focus on economic development as the single determinant for environmental quality. This might be attributed to the fact that the majority of EKC research is based on reduced simple form equations. The consequences of this could be conflicting theoretical explanations (Caviglia-Harris et al., 2009). Moreover, researchers have also commented on the sensitivity of the EKC to the changes in data, as stated "Merely cleaning up the data, or including newly available observations, makes the inverse-U shape disappear." (Harbaugh, Levinson and Wilson, 2000:2).

2.3 The relevance of consumption in the EKC model

The challenge with investigating the EKC is to find an appropriate measure for environmental degradation. This is because there are often difficulties in terms of comparing countries due to differences in natural resources and technological advancement. The sectoral emphasis might also be different due to the different specializations made possible through international trade. Consequently, a more aggregate measure of environmental pressure is needed to compare countries and by taking consumption rates into consideration. Furthermore, this would also allow us to measure the total impact an individual country has on the global environment.

2.3.1 The EF as a measure of environmental quality

The EF by Wackernagel and Rees (1996), has been widely used as proxy for researchers to investigate consumption and its impact on the environment. The EF measures the amount of natural capital and bio-productive land and sea area needed to support the demand and supply of our products and services, as well as the requirements for absorbing the waste from production and consumption (Ewing, Reed, Galli, Kitzes and Wackernagel, 2010). In other words, it measures how much damage our consumption impacts the biosphere and its capacity to regenerate the natural capital to its original state.

The strength of this indicator is in its simplicity with its "relatively easy calculation method" and the availability of data (Nijkamp, Rossi and Vindigni, 2004: 754). This provides clarity in the message which is vital to an indicator (Moffat, 2000). The logic behind the EF can be shown in the equation below where the dependent variable is the consumption indicator. The consumption factor is determined by the production variable which sums up all bio-productive areas within a country necessary to support consumption, and the net trade which shows the imports and exports relationship (Global Footprint Network, 2017). However, the simplicity of this indicator might have led to its criticism for producing incomplete results (ibid). This is supported by Fiala (2008) who argues that it is not possible for the EF to capture the technological change in production growth as it is a static measure.

$$EF_C = EF_P + (EF_I - EF_E)$$

Nevertheless, several studies have used EF as the indicator for environmental quality (Caviglia-Harris et al., 2009; Aşıcı and Acar, 2016; Mrabet and Alsamara, 2016). Thus far, the literature using EF as an environmental indicator has not been extensive. Furthermore, the research has not unanimously yielded statistically significant results to support the existence of EKCs. Regardless, the EF is recognized by researchers as the best aggregate measure for environmental quality at the moment and an important tool for policy makers (Caviglia-Harris et al., 2009).

2.3.2 Comparing the economy of Sweden and Albania

As explained earlier, the existence of an EKC can be partially explained by the level of structural change of the economy and the move towards a service economy. Therefore, a comparison between the sectoral and industrial differences between a developed and a developing country is appropriate. As a developed country, Sweden has been commended on being environmentally friendly. For instance, the Environmental Performance Index (EPI) has ranked Sweden in the top three for its performance of environmental policies (Epi.yale.edu, 2017). However, according to the Global Footprint Network (2017), Sweden is among the top 10 worst polluters in the world, compared to the 77th placement of Albania. This shows that taking consumption into account might give a more holistic view of the environmental impact between developed and developing countries.

Sweden is heavily dependent on foreign trade because its resource base consists mainly of “timber, hydropower, and iron ore” (cia.gov, 2016a). Moreover, the majority of its industries in manufacturing are in “iron and steel, precision equipment, wood pulp and paper products, processed foods and motor vehicles” (ibid). In comparison, Albania has focused on industries in “food and tobacco products, textiles, lumber, oil, cement, chemicals, mining, basic metals and hydropower” (cia.gov, 2016b). This shows that Sweden is still invested in dirty industries in terms of the definition provided by Mani and Wheeler (1997) illustrated in Table 2.

Table 2: Ranking of Pollution-Intensive Industries (Mani and Wheeler, 1997:5)

Rank	Air	Water	Metals	Overall
1	371 Iron and Steel	371 Iron and Steel	372 Non-Ferrous Metals	371 Iron and Steel
2	372 Non-Ferrous Metals	372 Non-Ferrous Metals	371 Iron and Steel	372 Non-Ferrous Metals
3	369 Non-Metallic Min. Prd.	341 Pulp and Paper	351 Industrial Chemicals	351 Industrial Chemicals
4	354 Misc. Petroleum, Coal Prd.	390 Miscellaneous Manufacturing	323 Leather Products	353 Petroleum Refineries
5	341 Pulp and Paper	351 Industrial Chemicals	361 Pottery	369 Non-Metallic Min Prd.
6	353 Petroleum Refineries	352 Other Chemicals	381 Metal Products	341 Pulp and Paper
7	351 Industrial Chemicals	313 Beverages	355 Rubber Products	352 Other Chemicals
8	352 Other Chemicals	311 Food Products	383 Electrical Products	355 Rubber Products
9	331 Wood Products	355 Rubber Products	382 Machinery	323 Leather Products
10	362 Glass Products	353 Petroleum Refineries	369 Non-Metallic Min. Prd.	381 Metal Products

Although the service sector of both Sweden and Albania contributes to approximately 64% of their respective economies, Table 3 clearly illustrates that Sweden is a developed country as it is more invested in the secondary and tertiary industries, whereas Albania still favors the primary industry compared to its secondary industry. This can be further observed in the results from the data visualized by the Observatory of Economic Complexity by Simoes and Hidalgo (2011). In 2014, Sweden imported more crude petroleum (7.15%) and exported less refined petroleum (6.89%), while Albania imported less refined petroleum (13%) and exported more crude petroleum (19.1%). In other words, Sweden imported crude oil for processing purposes while Albania largely imported refined petroleum for use rather than resale. This difference shows the stage of development in terms of the level of technological advancement.

Although the natural resource base and the technical complexity might play a part in the consumption of a country, it might also be dependent upon the trade composition. In 2014, Sweden had a positive trade balance of $5.78B in net exports while Albania had a trade deficit of $1.88B. However, Sweden was trading at a higher volume than Albania which might indicate that level of consumption could be the determining factor regarding the impact of a country on the global environment. Moreover, Sweden mainly imported goods and services from developed countries, while Albania imported goods from a mix of developed and developing countries. For instance, the top three countries Sweden imported from were Germany ($16.5B), followed by the Netherlands ($12.5B) and Denmark ($11.1B), while Albania mainly imported from Italy ($1.38B), Greece ($413M) and Turkey ($315M) (Simoes and Hidalgo, 2011).

Table 3: Sectoral emphasis (data from cia.gov, 2016)

Sectoral emphasis (2016 est.)	Sweden	Albania
Agriculture	1.7%	21.6%
Industry	34.2%	14.9%
Services	64%	65.3%

2.4 The conceptual framework

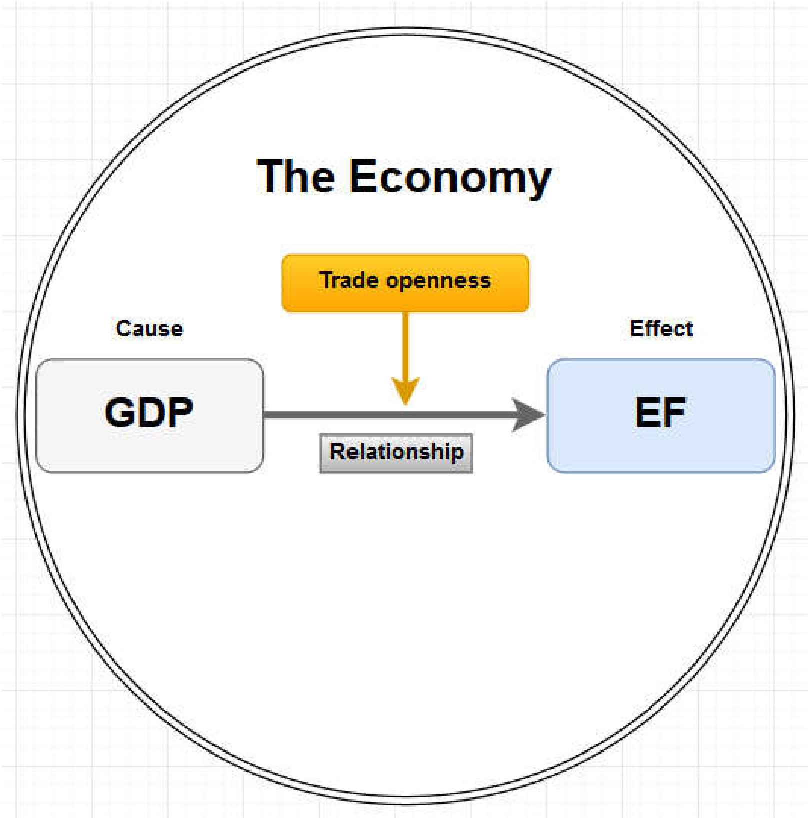

Figure 3: Conceptual Framework

The tentative conceptual framework, illustrated in Figure 3, shows the different relationships that might come into effect during the analysis. Firstly, income level is measured by GDP per capita which should directly affect the EF. Moreover, the pollution haven theory is taken into consideration by controlling this relationship with trade openness as the moderating variable.

2.5 Conclusion of the literature review

While the EKC has been widely used to explain how economic growth can potentially improve environmental quality, there are certain limitations of the framework that needs to be considered. For instance, researchers have pointed towards the N-shaped results, the weak statistical foundation and the divergent nature of the results to challenge this theory. More importantly, the lack of consideration for trade and the pollution haven hypothesis also brings to question the validity of the research on EKC. Therefore, to improve on the EKC framework, a consumption based indicator can be used to give a more holistic view of the situation. In other words, the EF could be used as an appropriate measure for environmental quality. Although researchers have recognized the limitations of the EF, they have argued that it is a good indicator due to its simplicity and clarity (Moffat, 2000). In short, although there are weaknesses in both the EKC and the EF, they might be appropriate for preliminary research into gauging the existence of a relationship between economic growth and environmental quality. However, due to their weaknesses it is important that the interpretation of the results will need to be considered carefully due to the limitations explained earlier. To conclude, the following section will therefore use the EKC, with EF as the environmental indicator, to explore and compare the relationship between environment and growth for the developed economy Sweden and the developing economy Albania.

3. METHODOLOGY

The main research method in this thesis will be quantitative in nature using secondary data analysis as the aim is to find how the environmental quality of Sweden and Albania is affected by the different consumption patterns which are attributed to economic growth. As explained in the literature review, the EF is used as the measure for the impact consumption has on the environment. However, there are a multitude of ways to construct an econometric model to analyze this relationship. The purpose of this chapter is therefore to give an overview of the research design and analytical process of how the research question can be answered in this study. This is mainly achieved in the four following sections which describes the process of analyzing the research question in-depth. Firstly, it intends to explore the relationship between economic growth and environmental quality. This is then followed by an explanation of the use of a regression model. Thirdly, the paper will address specific issues that might occur when running a regression model and suggest the use of cointegration to further test the relationship. The chapter will end with a detailed data collection process and variable explanation.

3.1 Relationship between EF and GDP per capita

3.1.1 Linear relationship between EF and GDP per capita

A model needs to be established to investigate the relationship between environmental quality and economic growth. Traditionally, this has either been a linear or quadratic relationship between some environmental indicator and an indicator for economic growth which is usually GDP per capita. In this case, the environmental indicator is the EF as it measures the global impact the consumption of a country has on the environment. Although, cubic relationships have been found in the form of N-shaped curves, it will not be included in this research as it has not been part of the statistically significant literature regarding EKCs. The following simple linear form is expressed as follows:

$$EF_{it} = \beta_0 + \beta_1 Y_{it} + \varepsilon_{it} \tag{1}$$

In this case, the EF is denoted by EF_{it} while GDP per capita is represented by Y_{it}, for country 'i' at time 't'. The coefficient β_0 shows the base level of environmental degradation, while β_1 is the coefficient for the change in EF due to a change in GDP per capita. ε_{it} is the error term or residual that represent the noise in the model. For this model, if $\beta_1 > 0$ and significant then the relationship is monotonically increasing. If $\beta_1 < 0$ and significant, the relationship is monotonically decreasing. If there is no significance within the 90% confidence interval, then the relationship is deemed inconclusive as there is too much "noise" in the data which detracts from the predictability of the econometric model. Moreover, since this is a linear relationship there is no turning point where environmental degradation decreases.

3.1.2 Quadratic relationship between EF and GDP per capita

The use of a quadratic equation will indicate whether the environmental degradation will rise to a point and diminish as a turning point of development has been achieved in the country. The quadratic form of the relationship can be expressed as follows:

$$EF_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 Y_{it}^2 + \varepsilon_{it} \tag{2}$$

This equation adds GDP per capita squared to Equation 1 to investigate the existence of an inverted U-shaped relationship. In this case, β_2 will be the change in EF due to a change in GDP per capita squared. In this case, it will show a delinking of GDP per capita and the EF if $\beta_1 > 0$ and $\beta_2 < 0$ occurs and the relationships are statistically significant. Hence, a turning point would exist at $T = -\beta_1 / 2\beta_2$. However, if $\beta_1 < 0$ and $\beta_2 > 0$ and statistically significant, a u-shaped pattern will be obtained, but it is not inverted and thus it is only an inflection point.

3.2 The use of multiple regression in EKC research

Equation 1 and 2 are used to show the general relationship between GDP per capita and EF because they address the core theory of the EKC which states that there is a relationship between environmental quality and economic growth. Moreover, they follow the general structure of all EKC literature and would provide an indication of the direction of the relationship between economic growth and environmental quality.

However, the issue with using EF as the environmental indicator is that a significant amount of literature has not yielded positive results for EKCs. This might raise questions regarding viability or feasibility of this type of research. Moreover, the results of the EKC are highly dependent on the research methodology, sample size and the independent variables used. In order to validate this research methodology, it is required to follow proven methodologies that can support this thesis by providing reliability for the research.

Notable authors such as Bagliani et al. (2008) and Caviglia-Harris et al. (2009) have used Ordinary Least Squares (OLS) to investigate the relationship between economic growth and environmental quality. For instance, Bagliani et al. (2008) used OLS on the three econometric models that they were investigating in terms of the effect of consumption. Recently, a research paper by Asici and Acar (2015) used a regression model to find that countries have the tendency to relocate their EF as their income increases. This paper used a quadratic econometric model shown in Equation 3, where environmental quality (y) was described by income per capita (x), income per capita squared (x^2) and the ‘z’ vector which included “openness, biocapacity, population density, industry value added share in GDP, energy use per capita, stringency of environmental regulation, and enforcement of environmental regulations” (Asici and Acar, 2015:711), in country ‘i' at time ‘t’. This equation is similar to Equation 2, but with added variables in order to control for the relationship.

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it}^2 + \beta_3 z_{it} + \varepsilon_{it} \tag{3}$$

Similarly, Mrabet and Alsamara (2016) goes in-depth into a specific country, Qatar, and succeeds in showing an EKC relationship between EF and growth. The authors based their research on the log linear quadratic form of their empirical equation shown in Equation 4. In this case, the dependent variable, environmental quality (ED) is described by the independent variables real income per capita (Y) and other covariates such as energy use per capita (EU), financial development (FD) and trade openness (EX), at time ‘t’.

$$\ln(ED)_t = ln\, Y_t + ln\, Y_t^2 + ln\, EU_t + ln\, FD_t + lnEX_t \tag{4}$$

Thus, these econometric models are used as guidelines for the regression model developed in this paper as they effectively address the purpose of the research question. Moreover, using these methods provides consistency for this thesis and helps it stay within the relevant realm of EKC research, and creates a comparable benchmark for the results from the data analysis. In short, the methodologies contributed to the expressed relationship between consumption, economic growth and environmental quality as shown below:

$$ln\,EF_{it} = \beta_0 + \beta_1\, ln(Y_{it}) + \beta_2\, ln(Y_{it})^2 + \beta_3 \ln(EX_{it}) + \varepsilon_{it} \quad (5)$$

The log-linear version was used as it will moderate the "sharpness in the time series data and allows for better results that control variance as compared to simple specification" (Mrabet and Alsamara, 2016:4). For the analysis in Chapter 4, the econometric model that will be used will be a slightly adapted version of Equation 3 by only including trade openness as it is essential to reduce the problems of omitted variable bias (Jalil and Mahmud, 2009). For Y^2, the natural logarithm was first taken of Y and then squared to allow for a quadratic relationship to occur. Moreover, the variables used by Asici and Acar (2015) were measuring for specific aspects of the footprint which is not relevant to this study of an aggregate footprint. For Equation 5, it is expected that $\beta_1 > 0$ since an increased income should lead to more environmental degradation. Moreover, β_2 is expected to be negative as this would indicate an inverted U-shaped curve. The sign of β_3 depends on the country that is studied as developing countries have generally less strict environmental laws and so we expect a positive sign, while for developed countries it should be negative.

3.3 The use of cointegration

Using a regression model might not be reliable enough for an EKC analysis which need to use Y and Y^2 as independent variables. This is because serial correlation will occur as one variable is directly derived from the other. Although these issues can be accepted and ignored in the model, it does not give sound results since the fundamental conditions are violated. Moreover, ignoring these issues will also create ambiguity regarding the validity and reliability of the results as the model will be affected by these issues. To ensure the applicability of the data, the cointegration approach will also be used to analyze the data. Several research papers have used this methodology to deal with spurious regression results due to the challenges of time series data at level form (Jalil and Mahmud, 2009; Mrabet and Alsamara, 2016, Waluyo and Terawaki, 2016).

Although one solution would be to difference the variables to make them stationary, the issue is that this might prevent a long-run analysis of the data (Jalil and Mahmud, 2009). To avoid this problem, cointegration may be used to investigate the long-run relationship of the variables. In this case, the autoregressive distributed lag model (ARDL) is used due to its several advantages over other cointegration tests. As Nkoro and Uko (2016) mentions, this method can be applied regardless of the level of integration whether the variables are I(0), I(1) or fractionally cointegrated. Moreover, the authors use the ARDL approach to cointegration as this “gives better results for small sample data (…) compared to other techniques” (Waluyo and Terawaki, 2016:92). Since the number of observations in this paper are limited to 29, ARDL is more appropriate. In the next chapter, the analysis will follow a similar procedure and reporting practices presented in these papers who used ARDL to investigate the EKCs.

3.3.1 The use of unit root test

Since the ARDL model only takes variables that are I(0) or I(1), the model is inconclusive when I(2) variables occur (Jalil and Ahmed, 2009). This is why a unit root test needs to be conducted for the variables to check for stationarity and to check that no variable is I(2) or greater. In this case, the results will be based on the Agumented Dickey Fuller (ADF) test following Mrabet and Alsamara (2016).

3.3.2 Optimal order lag length

Once the level of stationarity has been investigated, the ARDL cointegration will then be run using Eviews 9 software tool to check for the optimal order of lag length. This will be determined by the Akaike information criterion (AIC) and Schwarz information criterion (SC) scores generated by the software to select the optimum lag length of vector autoregressive (VAR). The former criterion gives the maximum relevant lag length while the latter selects the smallest possible lag length.

3.3.3 Establish a long-run relationship

The relationships between the variables can be investigated once lag length has been established. The long-run relationship will be investigated by the ARDL model results and the direction of causality will also be investigated. This is because the direction of causality is often taken for granted in an OLS regression, whereas an ARDL model has the possibility to establish the direction of causality.

3.3.4 Residual plots and stability

The goodness of fit needs to be tested for the model. Hence, serial correlation, heteroscedasticity and normality will be conducted for the data. In addition, a stability test will be used to determine the constancy of the coefficients in the model. For instance, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) will be used to check if the model stays within the boundaries of 5% level of significance.

3.4 Data collection and variable explanations

For convenience, the data was organized into two separate sets for the countries Sweden and Albania. The time period for the data used is between 1984 to 2012. The following section will explore the dataset to give an overview of the process leading up to the analytical process. The data collection and a detailed variable explanation will be presented. A summary of the data collection sources and measured are summarized in Table 4.

Table 4: Variables and data sources

Variable	Measures	Source
Ecological Footprint(EF) (consumption per capita)	Global hectares(gha)	Global Footprint Network (2016)
GDP per capita	In 2015 USD	World Development Index
Trade Openness(EX)	Exports, Imports, % of GDP	World Development Index

3.4.1 Dependent variable – EF

Ecological Footprint (EF). The purpose of this research is to conduct time series regression analysis to compare a developing country, Albania, with a developed country, Sweden. The data collected were used for time series analysis that should span from 1980 to 2012 following the research design by Mrabet and Alsamara (2016). The data was gathered from the Global Footprint Network (2016). A one-year license for the time series dataset for Sweden and Albania was obtained directly from the Global Footprint Network through an e-mail request. This dataset contains the total EF for Sweden and Albania from 1961 to 2008, the cropland area, forest land, fishing grounds, grazing land and built-up land.

The EF is measured by several components such as consumption, exports, imports, production and area. In this case, the component used will be the consumption based footprint per capita as it is more appropriate to compare countries with varied amount of population. Moreover, this means that population density is not needed to weight the data.

The Global Footprint Network uses primarily data from the United Nations (UN) and sources from studies in peer-reviewed science journals. Moreover, they specify that the footprint is calculated by taking the "amount of material consumed by that person" and divide it by the yield of the specific land or sea area (Global Footprint Network, 2016). This is then "converted to global hectares using yield and equivalence factors" and the sum of the global hectares needed is then the total footprint of that individual (ibid). The footprint can be overshoot if there is an ecological deficit, which is currently the situation in most countries in the world.

3.4.2 Independent variables – GDP and EX

GDP per capita (GDP) is used as the first explanatory variable as it is often used in EKC literature. The GDP per capita data measured in current US dollars was downloaded directly from the World Bank database. The source from the data was the World Bank national accounts data and the OECD National Accounts data files. The dataset consisted of 217 countries with a time series spanning from 1960 to 2016. On the website, it is specified that the GDP was calculated by taking all the production in the economy plus taxes and deducting that by the subsidies that were not included in the value of the products. The calculated GDP was then divided by the midyear population of the corresponding year.

Trade openness (EX) is an explanatory variable that indicates the amount of trade in a country and indicates the level of liberalization of a country. It is measured as the sum of the exports and imports as a percentage of GDP. Similar to the other two variables, the data included 217 countries with a time series spanning from 1960 to 2016. The data for trade openness was sourced from the same database used for GDP.

4. ANALYSIS

This section examines the empirical findings of the research regarding the EKC in terms of the trend between consumption and economic growth. The data collected was analyzed using a combination of Microsoft Excel, IBM SPSS 23.0 and Eview 9 due to their different emphasis on visual and analytical tools. This analysis intends to present the results of the hypothesis testing through multiple variable regression analysis in IBM SPSS 23.0 and ARDL bound testing in Eviews 9. The analysis will be conducted in the following stages. Firstly, there will be a visualization of the trend in EF and GDP per capita between Sweden and Albania to gain an overview of the situation. Secondly, the econometric models outlined in the methodology chapter will be regressed and compared. Thirdly, an ARDL test for cointegration will be used to examine the relationship between the variables further since regressions are unstable in terms of time series. This chapter will end with a summary of the findings.

4.1 Trend lines of EF in Sweden and Albania from 1984 to 2012

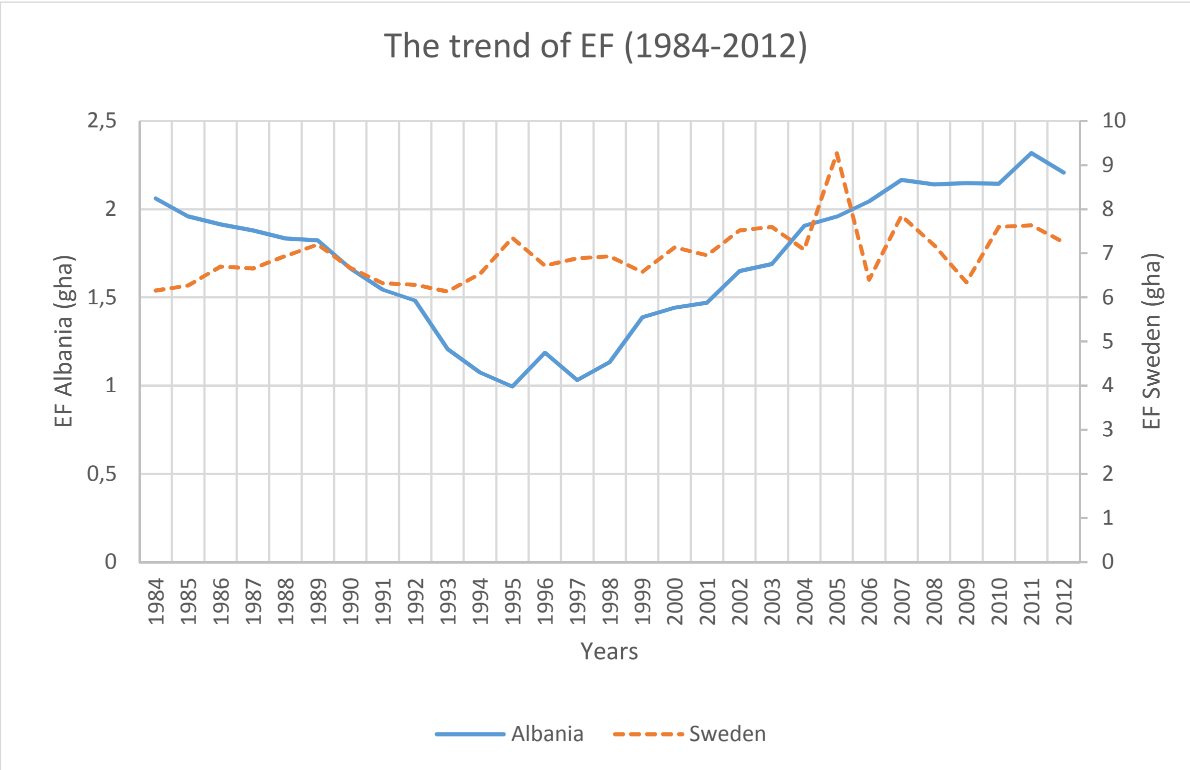

Figure 4: Trend of EF levels from 1984-2012 for Albania and Sweden

As shown in Figure 4, the trend line of Sweden (orange) seems to be relatively stable from 1984 to 2012. Moreover, Figure 5 shows a relatively stable economic growth for Sweden. However, Albania (blue) seems to experience large fluctuations with a dip around 1991 to 1999. This could be attributed to the unstable environment of Albania during this period where there was a shift in political ideology from communism to socialism. This was led by the fall of the Berlin wall in 1989 which signified the end of communism. Although this change opened relations to the west, the inadequate financial system was being exploited by allowing informal markets to emerge. In short, its inexperience with capitalism led to the perfect environment for pyramid schemes to thrive. This eventually led to a collapse of the pyramid schemes in 1997 whereby it brought down "the Democratic Party government, and plunging Albania into anarchy" (Jarvis, 1999:17). The social, political and financial instability had a visible effect in terms of production and consumption in Albania as seen in the lowered EF during this period. Moreover, in Figure 5 there are corresponding dips in the early 1990s and again around 1997, which indicates decreased economic growth of the country, which might have caused the decreased EF in that period. However, after 1997 the economic trajectory seems to have increased and there has been a steady increase in the EF since then.

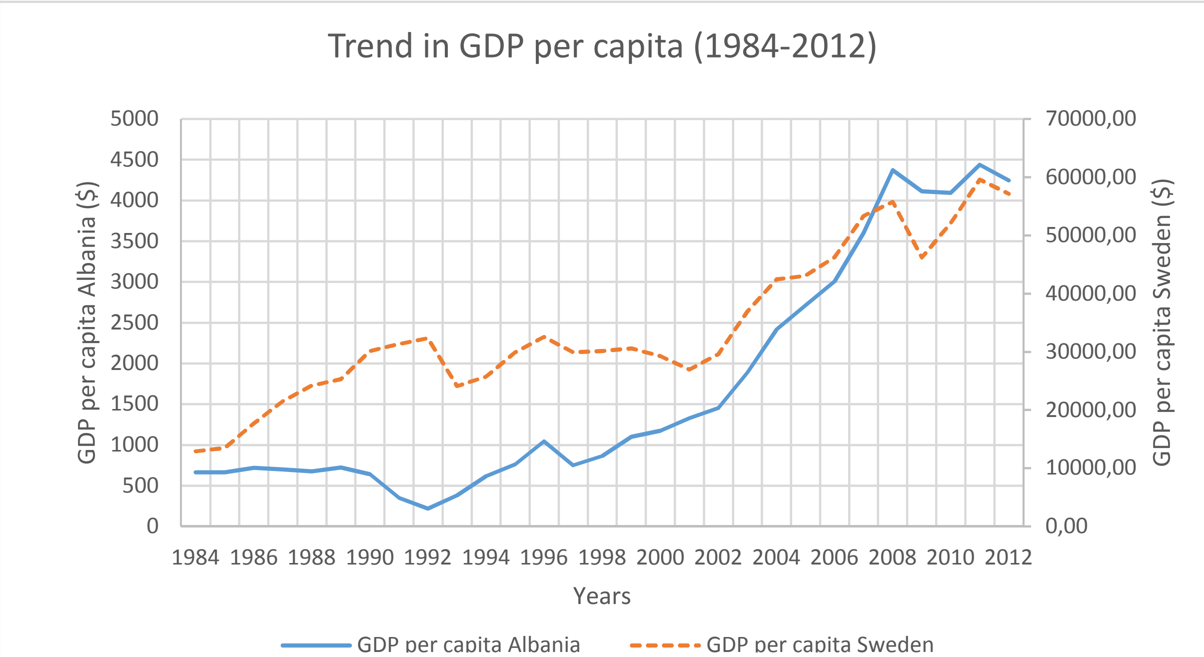

Figure 5: Trend of GDP levels from 1984-2012 for Albania and Sweden

4.2 Regression of GDP per capita and EF

4.2.1 The linear relationship between EF and GDP per capita

The relationship between EF and GDP per capita can be expressed in the model below:

$$\textbf{Model 1: } EF = \beta_0 + Y + \varepsilon$$

Model 1 for Sweden, shown by Figure 6, does not seem to display the characteristics of an inverted U-shaped curve between GDP per capita and the EF. Although there seems to be a slight increasing trend, the outliers make this data inconclusive. In contrast, EF and GDP per capita for Albania shown in Figure 7 seems to allude to an linear relationship that is increasing. However, some of the plots are clustered to the left which does not indicate a satisfactory linear relationship and might even hint towards a quadratic relationship.

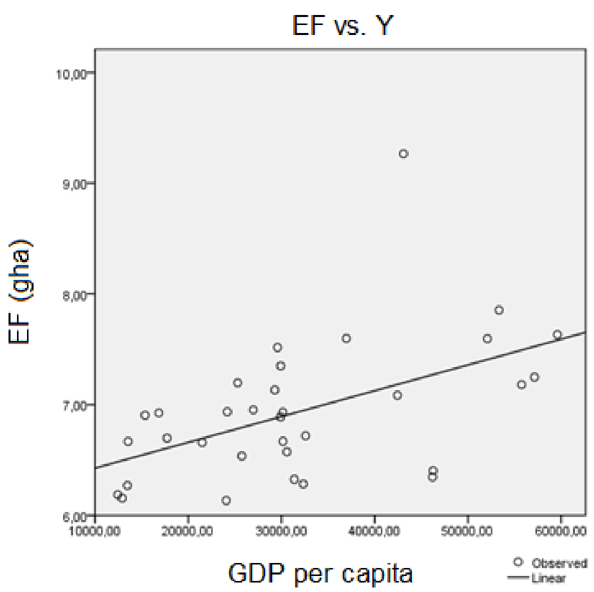

Figure 6: Scatterplot of EF and Y (Sweden)

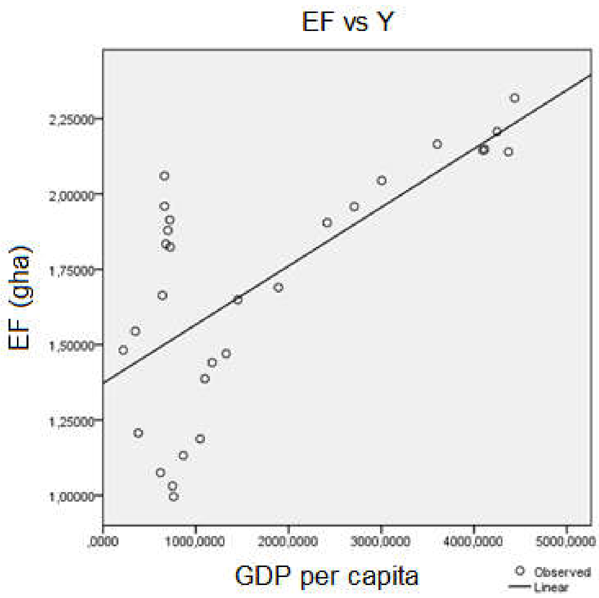

Figure 7: Scatterplot of EF and Y (Albania)

4.2.2 The quadratic relationship between EF and GDP per capita

The quadratic relationship between GDP per capita and the EF is shown in the model below:

$$\textbf{Model 2}: EF = \beta_0 + Y + Y^2 + \varepsilon$$

A hierarchical regression method is used to run model 2 in IBM SPSS 23.0 due to the independent variable Y^2 is polynomial in nature and a simple linear regression cannot be used. In this case, Albania shows a clear curve approaching its turning point as illustrated in Figure 8. However, the issue is that the economic and political turmoil experienced in Albania in the early 1990s which might distort the picture. In Figure 9, it shows similar results as to those from model 1. In other words, Sweden does not show a significant inverted U- shaped relationship due to the dispersed data points.

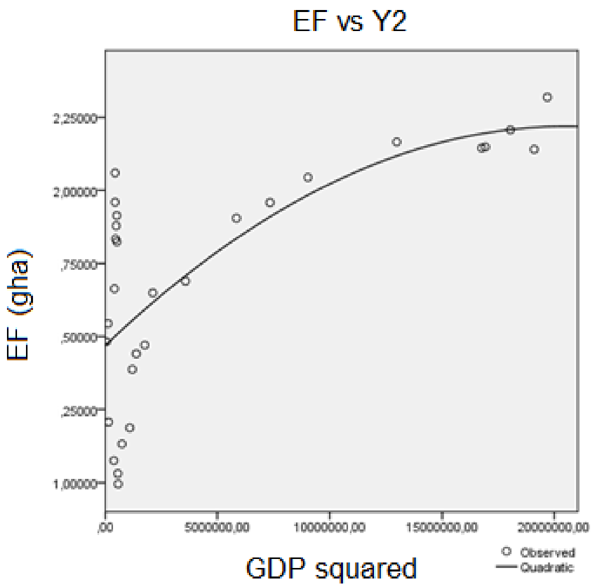

Figure 8: Scatterplot of EF and Y^2 (Albania)

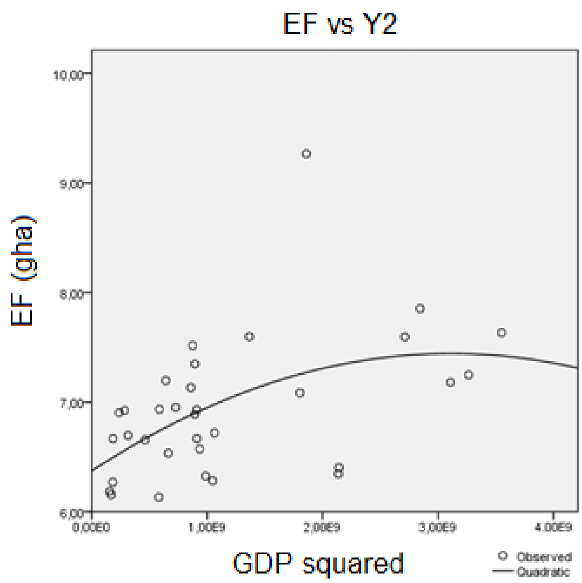

Figure 9: Scatterplot of EF and Y^2 (Sweden)

Table 5 shows the regression results of the models. Neither model 1 nor model 2 seem to have high explanatory power. This is expected from the low number of observations. For Sweden Y accounts for under 30% of the explanation of the dependent variable while it is just below 50% for Albania. This indicates a better model fit for Albania than Sweden. Although model 2 explains the variance slightly better in terms of R^2 in both cases, much of the variance in EF is not accounted for. This is understandable as the EF is a global environmental indicator which cannot be solely captured by economic growth, and other independent variables might be added to increase the strength of the model.

Table 5: Comparison of OLS estimates for Sweden and Albania (**p<0.05, ***p<0.01)

	Model 1	Model 2c	Model 1	Model 2c
Dependent variable: EF (t-stat)	6.105 (19.652)	7.039 (47.027)	1.372 (16.190)	1.662 (16.438)
YE-5 (t-stat)	2.532 (2.968)**	2.783 (2.958)**	0 (5.090)**	0 (2.511)**
Y^2 (t-stat)	N/A	-4.286E-5 (-0.666)	N/A	2.190E-3 (0.511)
R^2	0.256	0.259	0.490	0.495
F-stat	10.646**	4.537**	25.947***	12.749***
Durbin Watson	2.176	2.310	0.155	0.167
Observations	29	29	29	29

Furthermore, the Durbin and Watson scores for Sweden are between 1.5 and 2.5 which suggests no autocorrelation, whereas for Albania it suggests a positive first order autocorrelation. The issue is that the autocorrelation between the variables might hinder us to draw a reliable conclusion from the data. Moreover, since the two independent variables are dependent on each other, multicollinearity will be a problem due to high correlation but this is generally accepted in this model because of the perfectly correlated Y and Y^2 (Allison, 2012).

Although the F-statistics and t-statistics are significant for all models in both countries which indicates that there might be a relationship between Y and EF, the coefficients for Albania do not seem to be statistically significant and no relationship can be drawn from this method. The results show that for Sweden there might be a monotonically increasing trend within the 95% confidence interval. However, the linear regression model cannot be trusted in this case as Figure 6 points towards a violation of the assumption that there is an existence of a linear relationship between Y and EF. Hence, the results remain inconclusive in this case. Moreover, the results for Model 2 show no significant values within the 95% confidence interval and so they are inconclusive at this point so from this analysis it implies that there is no delinking relationship between GDP per capita and EF for either country.

4.2.3 The log-linear relationship between EF and GDP and its covariates

A log-linear relationship similar to the one used by Mrabet and Alsamara (2016) is tested as an alternative means to investigate the relationship between consumption and environmental quality. Since economic growth could not explain the majority of the variance for EF, another model needs to be used to better explain how consumption affects environmental quality. Hence, model 3 specified in the methodology section under Equation 5 will be used.

Model 3:

$$ln\, EF_{it} = \beta_0 + \ \beta_1\, ln(Y)_{it} + \beta_2 \ln(Y)_{it}^2 + \beta_3 \ln(EX)_{it} + \varepsilon_{it}$$

The β_0 is represents the baseline emissions, β_1 is the change in EF due to a change in Y, β_2 is the change in EF due to a change in Y^2 per capita and β_4 is the change in EF due to the change in trade openness. The error term denotes the other explanations of EF that is not covered in the model. A summary of statistics of the raw data can be seen in Appendix A. Using IBM SPSS 23.0 software to test for the main effect hypotheses shown in Table 6, a linear regression analysis was conducted, where the control variable “trade openness”, and the predictors “GDP per capita” and “GDP per capita squared” was entered in model 1.

Table 6: Regression results Sweden and Albania (**p<0.05, ***p<0.01)

	Sweden	Albania
Intercept (t-stat)	-22.910 (-2.342)	13.075 (3.769)
Y (t-stat)	3.575 (2.157)**	-3.283(-3.722)***
Y^2 (t-stat)	-0.163 (-2.053)**	0.251(3.951)***
EX (t-stat)	0.379(3.077)***	-0.052 (-3.364)***
R^2	0.507	0.777
F-stat	6.160***	12.720***
Durbin Watson	2.989	0.544
Observations	29	29

Table 6 shows the results from the regression analysis. Although the results for both shows that the f-statistics and t-statistics are all significant, the linear regression is inapplicable with the current datasets for Sweden and Albania. From the results, the model does not seem to work for Sweden as the intercept is negative. While in Albania's case, it seems that the model might work, but the low Durbin-Watson score suggests autocorrelation within the dataset. Although the forecasts are still unbiased under autocorrelation in terms of the results not being "wrong", but they might not be as precise. For instance, autocorrelation leads to inflated R^2 as seen in the table above, and renders the t and F distributions unreliable. In other words, a linear regression of the logarithmic form for this dataset is inapplicable.

Moreover, multicollinearity occurs as shown in the correlation results in Table 7 and 8. There is a positive and significant relationship between all independent variables. Multicollinearity is ignored in this case as we know that the study variables Y and Y^2 are perfectly correlated. The issue is that the dataset is limited to only 29 observations. Hence, changing the model a little will result in huge difference in the outcome and might provide inaccurate results and affect the calculations for individual predictors. In short, the linear regression model cannot be used to interpret the relationship for Sweden and Albania in this case as any conclusion drawn from the data would not be precise.

Table 7: Correlation table for Sweden

	μ	σ	1	2	3
Dependent					
1. Ecological Footprint	1.93	0.09			
Control					
2. EX	4.28	0.18	0.56**		
Independent					
3. Y	10.37	0.40	0.52**	0.67**	
4. Y^2	107.6	8.15	0.52**	0.68**	1.00**
N=29, **p<0.05					

Table 8: Correlation table for Albania

	μ	σ	1	2	3
Dependent					
1. Ecological Footprint	0.51	0.25			
Control					
2. EX	4.01	0.37	0.28		
Independent					
3. Y	7.10	0.85	0.59**	0.60**	
4. Y^2	51.17	12.25	0.61**	0.63**	0.99**
N=29, **p<0.05					

4.3 The ARDL model

A test of cointegration might be more appropriate when investigating the long-run relationship between GDP per capita and EF.

4.3.1 Unit root test for stationarity

As shown in the diagrams in Appendix A.1 and A.2, the variables are not stationary. In other words, their statistical properties such as mean, variance and autocorrelation are not constant over time (Nau, 2017). This means that there will be issues regarding the predictability of the variables because you cannot obtain meaningful sample statistics such as correlations from the variables. Stationarity in time series is important because spurious regression might show high statistic significance and high R^2 which might lead to a misleading conclusion of a statistically significant relationship between the variables where there should not be in a priori (Gujarati and Porter, 2009).

Running a Unit Root test in Eviews 9 showed that the null hypothesis of unit roots could not be rejected within the 95% confidence interval at the level stage. However, the Augumented Dickey-Fuller (ADF) test statistic shows that EF has a higher τ statistic than the critical values and so it is stationary at the first difference. The results can be seen in Appendix B which shows stationarity when we take the first difference of the series. Similarly, the tests showed that all the other variables for both Albania and Sweden were stationary at first difference within the 5% significance level.

4.3.2 Running the ARDL model

The consensus among the AIC and SC criteria was an optimal lag length of 4, as shown in Appendix C.1, as this does not give issues with serial correlation. For Sweden, the lag length will be 1 following SC (Appendix C.2) as it uses the smallest possible lag length which minimizes the loss of degrees of freedom.

The bound test for Albania for order of lag 4 shows that the F-statistic is 9.7019 (Appendix D.1) which exceeds the 1% critical value for the upper bound which is I(0) = 3.65 and I(1) = 4.66. For Sweden, the F-statistic is 10.3834 (Appendix D.2) for lag 1 which is also greater than the 1% significance of the upper bound. This means that there are long-run relationships between the variables in both scenarios. Since this does not give specific indications of how the relationships are constructed, a Granger causality test is run to check the direction of causality as shown in Table 9 and 10. The results show that there is a one-way causal relationship running from GDP per capita to EF at the 10% significance level which also holds for Y^2 for Sweden. However, Albania only has a one-way causal relationship running from Y to EF at the 10% significance level. In other words, we cannot reject the null hypothesis that Y^2 does not cause EF at lag 4. The weak relationship might be due to the small sample sizes used which cannot satisfy “the asymptotics that the cointegration of causality tests rely on” (Giles, 2011). This is especially important to consider since the data is lagged 4 times in Albania’s case which lowers the degree of freedom in the dataset. Hence, a larger significance level is accepted for this analysis.

Table 9: Granger causality test for Albania using lag 4 (*p<0.1)

	F-stat	Prob
Y does not Granger cause EF	2.4386	0.0894*
EF does not Granger cause Y	0.7177	0.5921
Y^2 does not Granger cause EF	2.1892	0.5921
EF does not Granger cause Y^2	0.8139	0.5346

Table 10: Granger causality test for Sweden using lag 1 (*p<0.1)

	F-stat	Prob
Y does not Granger cause EF	3.1082	0.0901*
EF does not Granger cause Y	2.3026	0.1417
Y^2 does not Granger cause EF	3.0911	0.0910*
EF does not Granger cause Y^2	2.2244	0.1484

The ARDL model showed that ARDL (1,0,1,0) for Sweden were preferred in terms of the SC criterion, while ARDL (4,3,4,4) was chosen for Albania. The long-run estimates are presented in Table 11. The results for Sweden show that the long-run relationship exists as the error cointegration term is negative (-1.3301) and significant. Moreover, it shows that there is a statistical significant EX. This implies that a 1% increase in EX will result in a 0.28% increase in EF which is unexpected for a developed country such as Sweden. However, the main issue is that there is no significant relationship between Y and the EF for Sweden. Hence, the EKC does not hold for this model in this case.

Similarly, the ARDL model for Albania shows a negative (-0.4014) and statistically significant cointegration variable which indicates the existence of a long-run relationship between the variables. In this case, Y is positive and statistically significant. This implies that a 1% increase in Y will increase the EF by 13.2%. Moreover, the negative and statistically significant value for Y^2 indicates the existence of an inverted U-shaped curve. In other words, this confirms the hypothesis of the existence of an EKC and a delinking of economic growth to environmental degradation. The turning point for the curve is around $1808.6 per capita.

Table 11: Long-run coefficients of cointegration (**p<0.05, ***p<0.01)

	Sweden	Albania
Models	ARDL(1,0,1,0)	ARDL (4,3,4,4).
Y (t-stat)	1.7164 (1.4079)	13.1975 (3.1760)***
Y^2 (t-stat)	-0.0810(-0.1366)	-0.8798(-3.0534)***
EX (t-stat)	0.2477(3.0480)***	0.8277(1.7766)
Intercept (t-stat)	-8.2111(-1.2856)	-51.4369(-3.1229)
Serial correlation(Chi-sq.)	6.160***	12.720***
Heteroskedasticity(Chi-sq.)	2.898	0.544
Normality(prob)	0	0.7882

4.3.3 Diagnostics and stability test

To check whether the models are reliable, diagnostic and stability tests are conducted on the data. Table 11 summarizes the results from the diagnostics test. This shows that the data for Albania are fine while the data for Sweden are not normally distributed. Moreover, a stability test was conducted for the different scenarios. For Albania, shown in Figure 10, the CUSUM and CUSUMSQ techniques were used to find the stability of the data. Both plots show that the coefficients are all within the critical bounds meaning that the ECM model is stable. However, Sweden breaks the CUSUMSQ 5% boundary as shown in Figure 11, but not by much. However, this in addition to the issue with normality of the data means that the interpretation of the results for Sweden should be made conservatively.

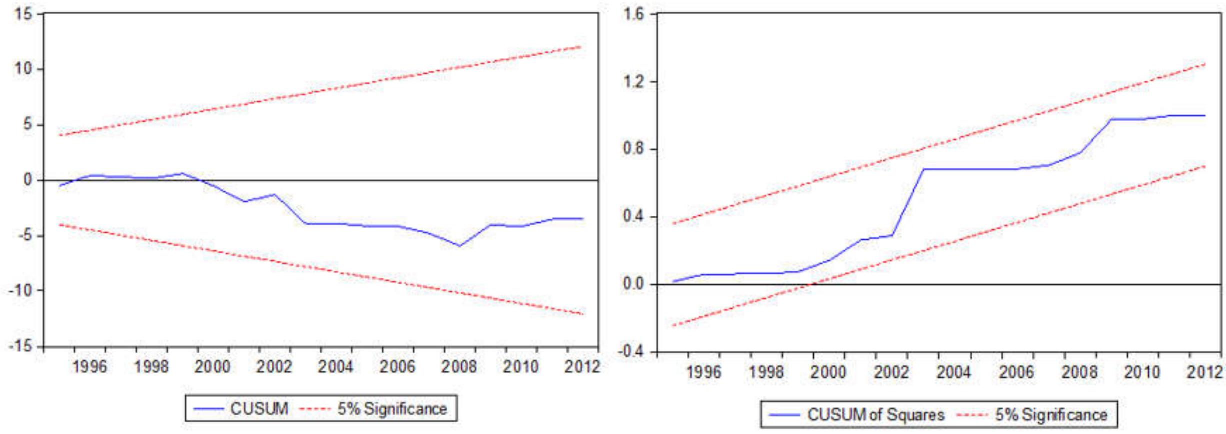

Figure 10: Plot of cumulative sum of recursive and squares of residuals for Albania

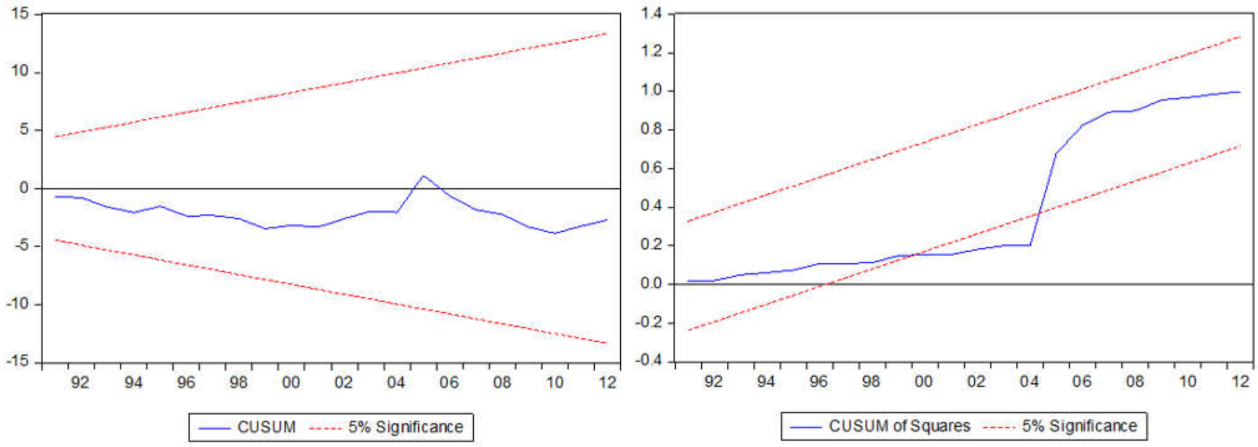

Figure 11: Plot of cumulative sum of recursive and squares of resudals for Sweden

5. DISCUSSION

The goal of this thesis was to examine and compare the impact on the global environmental quality of developed and developing countries. The research method used in this thesis followed a similar ARDL approach used in research papers such as Jalil and Mahmud (2009), Mrabet and Alsamara (2016), and Waluyo and Terawaki (2016). According to these papers, a long-run EKC has been found for CO_2 in China, the EF in Qatar and deforestation in Indonesia, respectively. This paper intended to find if a similar effect would be achieved for EF in Sweden and Albania based on data from the period between 1984 and 2012. In other words, the long-run relationship between income per capita and EF was investigated using the EKC framework. Moreover, the analysis contributes to interesting observations which facilitates a discussion around accountability and effective environmental policies for developing and developed countries. The following three sections will first present the main findings of the research. This is then followed by a discussion on the implications of the research. Lastly, the limitations of the research and suggestion for future research areas will be outlined.

5.1 Main findings

To summarize, two main hypotheses were stated. Firstly, Hypothesis 1 stated that there is an observable inverted U-shaped curve between income per capita and the EF in Sweden. In other words, there would be a parabolic relationship between income per capita and the EF. For this to happen the coefficients $\beta_1 > 0$ and $\beta_2 < 0$ there is an inverted U-shaped relationship. Secondly, Hypothesis 2 stated that there is not an observable inverted U-shaped curve between income per capita and the EF in Albania due to its status as a developing country. In short, that there would be no significance between EF and Y. Moreover, these relationships were controlled for with EX which is believed to be positive for Albania and negative for Sweden. Although using regression analysis did not yield favorable results due to the violations of the assumptions, the ARDL model yielded results favorable to the analysis of the EKC.

5.1.1 No visible EKC for Sweden

The cointegration test results suggest that there is no existence of an EKC relationship between GDP per capita and GPD per capita squared. The long-run effects were not significant to the 5% significance level for these variables. Moreover, the control variable EX had a long-run effect on EF. This means that there is no inverted U-shaped relationship for Sweden based on the dataset used in this research. Furthermore, the scatter plot shown in Figure 6 did not show a visible relationship between Y and Y^2 to EF. In other words, Hypothesis 1 should be rejected. Although the Granger Causality test showed a one-way causal direction running from Y and Y^2 to EF, the regression results shows that Sweden might experience a monotonically increasing degradation with increased capita. Hence, there are conflicting conclusions that might be drawn from the results. The main issue with the data is that it is not normally distributed and the CUSUMSQ test did not hold, which supports the conclusion that the global environmental degradation does not decouple from economic growth in Sweden. Furthermore, the control variable seemed to have a stronger relationship to EF than the independent variables which supports the conclusion that an increase in economic growth does not lead to improved environmental quality.

5.1.2 The existence of EKC for Albania

Hypothesis 2 suggested that there is not an observable inverted U-shape curve between income per capita and EF in Albania. However, this needs to be rejected based on the ARDL results. The cointegration results suggest the existence of a long-run relationship among economic growth and the global environmental quality. The long-run effects of GDP per capita and GDP per capita squared on EF were found to be positive and negative, respectively. This indicates the existence of an inverted U-shaped curve and Hypothesis 2 is rejected. In other words, the empirical findings support the validity of EKC hypothesis when EF is used as an indicator for environmental quality. This result is consistent with the conclusions provided by other research papers focused on developing countries (Jalil and Mahmud, 2009; Mrabet and Alsamara, 2016; Waluyo and Terawaki, 2016). Furthermore, the turning point was found to be \$1808.6 per capita which is within the range of the data set used which means it has already been reached by Albania. In addition, the control variable did not show a significant relationship towards the EF which supports the conclusion that economic growth has improved environmental quality in Albania. However, the result does not reflect the situation for all developing countries although the ARDL framework is useful in evaluating the existence of an EKC hypothesis.

5.2 Implications of the research

The findings suggest that for a developing country like Albania, EKC can be found while there is no EKC for a developed country like Sweden. The findings support the EKC critique by Stern (2004) which mentions that developing countries can outperform developed countries in terms of satisfying the EKC framework. As shown, Albania achieved the curve at a lower level than most developed countries in other studies. In other words, Albania shows a decoupling of economic growth and environmental quality while Sweden does not. This means that increased economic growth of Albania leads to a lowered impact on the environment. Moreover, the results indicate that developing countries do not necessarily need to follow the same economic growth path as developed countries in the past. In fact, for Albania a decoupling of economic growth and environmental quality happened while it is still developing its economy. Additionally, the results imply that developing countries might be justified in polluting more in the beginning stages as they are still able to reach their turning point. This is encouraging in terms of justifying the decisions of giving developing countries a wider breath when it comes to environmental laws.

Furthermore, the result raises the question of responsibility. In short, it questions whether developed countries should take more active role and increase initiative in combating environmental issues by enforcing stricter environmental policies. This means that developed countries such as Sweden should make more effort in showing accountability for the environmental damages they have caused in the past, while allowing developing countries to grow their economies. This is especially important considering the economic consequences of environmental degradation that is mostly harming developing countries which contribute only a small part to the problem. In this case, it seems that Sweden should continue to strengthen their stringent environmental laws. Moreover, since trade openness was positive and significant in Sweden's case, it might mean that cutting down on imports and exports could be a viable option to lower the consumption impact. However, this is highly unlikely for a country that is dependent on trade. Although policies can be made to ensure incentives for cutting down or substituting specific areas of consumption with lower environmental impact.

5.3 Limitations and suggestions for further research

Although the results have shown positive results for an EKC for Albania, the scope of the research has been limited by the time period and countries studied. The main issue with EKC research is the lack of a standard research method which leaves room for different results and interpretation of the data. For instance, this thesis used the ARDL bound test, while other authors have used regression analysis which might lead to different outcomes. In terms of this thesis, the issue was with the limited number of observations available for most developing countries. This is because small changes in the data will have a larger impact on the results and may distort the picture. Moreover, due to the limited countries explored in the thesis and variables it is difficult to conclude any specific trends in developed or developing countries. Furthermore, the research was also ignored short-run EKC relationship due to the challenge of using the small number of observations. Moreover, the differences such as government intervention and stringency of environmental laws in the chosen countries were not taken into account in this thesis.

The limitations of this thesis mean that the results need to be interpreted with caution, and that further research is needed on the topic of EKC which this thesis did not cover. Hence, further studies should investigate the following:

I) The differences in trends between environmental quality and economic growth for developing and developed countries across Europe.

II) The existence of a short-run EKC for Sweden and Albania, and the comparative difference between the short and long-run EKC.

III) The importance of government intervention, stringency of environmental laws and enforcement of laws on the EKC in Albania and Sweden.

6. CONCLUSION

The purpose of this paper was to investigate how the differences in consumption of developing and developed countries impacted the global environmental quality. More specifically, this paper used the EKC framework through the ARDL bound test method in order to find the environmental impact of the economic growth in Sweden (developed economy) and Albania (developing economy). As previous literature gave conflicting results regarding the existence of the EKC, the EF was used as the environmental indicator to measure the global environmental impact. In short, the theory if increased economic development leads to a better environment was explored.

The two main findings of the research can be summarized as follows:

I) The findings indicate that there is no inverted U-shaped EKC for Sweden using the EF as the global environmental indicator. In other words, there is no evidence for a decoupling of economic growth and the global environmental quality in this case. However, due to the issues present in the limited dataset the results are inconclusive at best.

II) There exists a long-run inverted U-shaped EKC for Albania using the EF as a global environmental indicator. Moreover, the findings indicate that Albania has a turning point of around $1808.6. This means that Albania has already decoupled its economic growth from its global environmental impact.

Additionally, trade openness did not influence the results found in Albania which suggests that the EKC was not reached by exporting its dirty industry elsewhere. In other words, this indicates that the pollution haven theory might not be significant in the case of developing countries. Moreover, the fact that Albania managed to reach its turning point at such a low level sparks the question of responsibility of developed countries to limit their own pollution, while allowing developing countries to grow. However, due to the limited observations and countries it is difficult to draw significant conclusions from this paper. Hence, further research needs to be made in terms of looking at the general trend in Europe for countries at different economic stages, the short-run EKC and importance of environmental laws.

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8. Appendices

Appendix A: Raw data summary statistics

Variables	Observations	Mean	St. Dev	Minimum	Maximum
Ecological Footprint	29	1.705	0.398	0.995	2.319
GDP per capita	29	1714.344	1432.833	218.492	4437.812
Trade openness	29	58.707	21.091	30.525	58.707

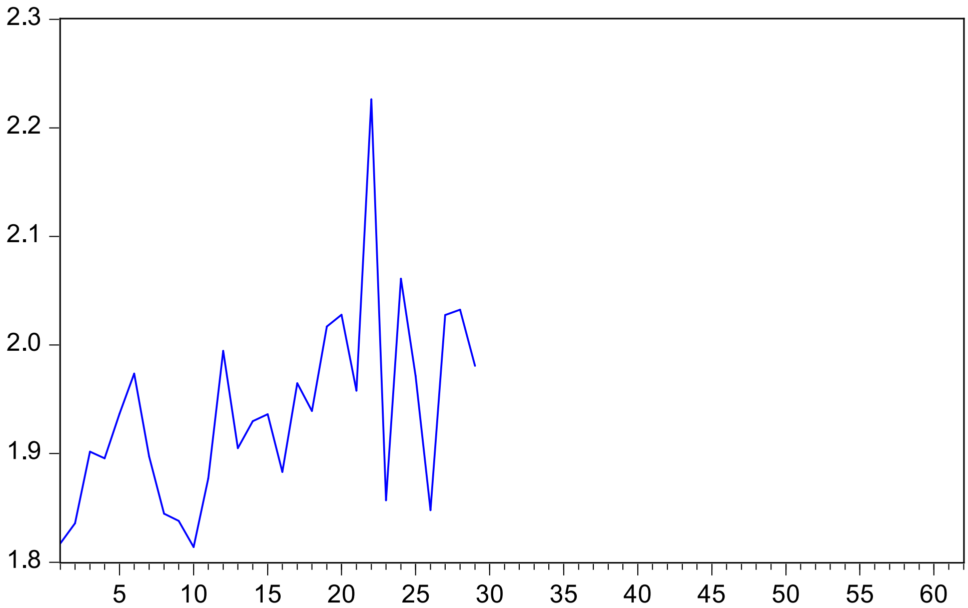
Table summary statistics of main variables for Albania

Variables	Observations	Mean	St. Dev	Minimum	Maximum
Ecological Footprint	29	6.97	0.656	6.13	9.27
GDP per capita	29	34157.431	12856.325	12914.33	59593.68
Trade openness	29	72.955	12.468	51.72	93.36

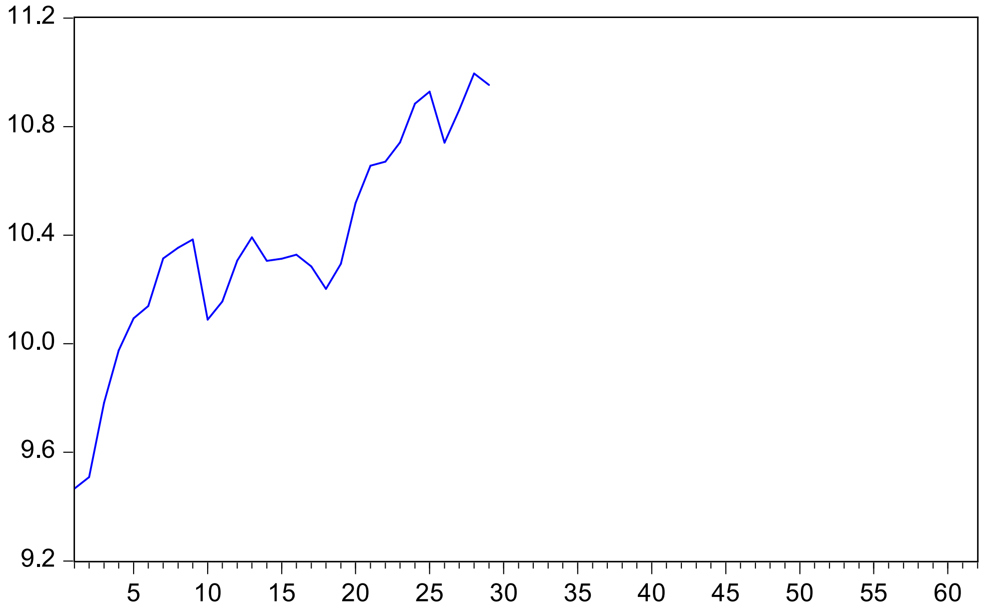
Table summary statistics of main variables for Sweden

Appendix A.1: Sweden Non-stationary Variables

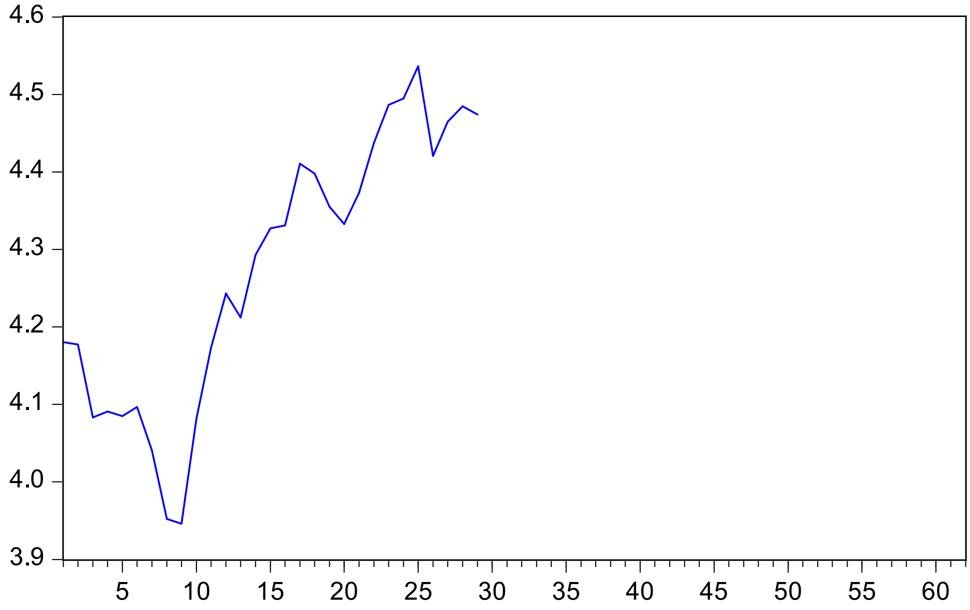
LN_EF



LN_GDP1

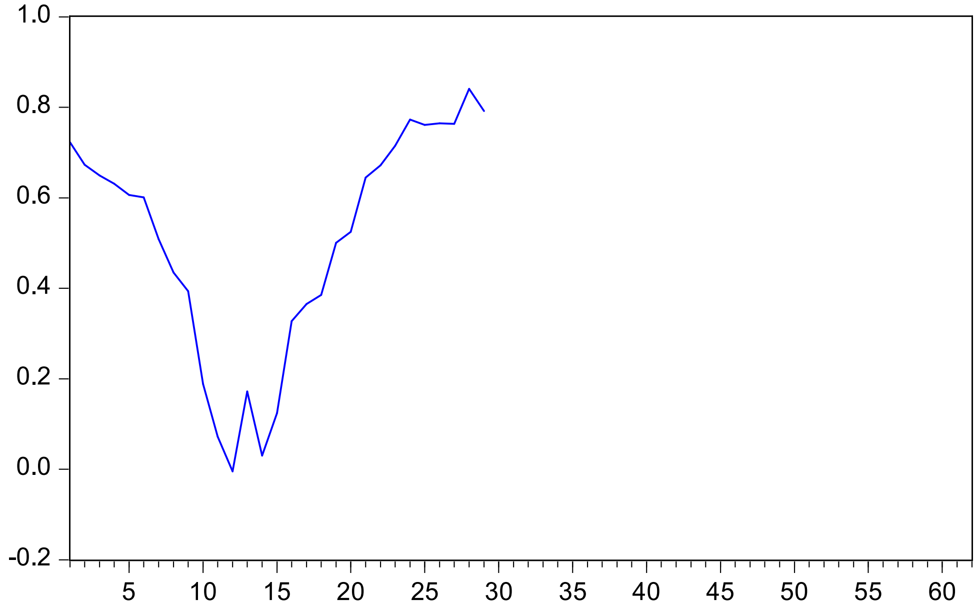


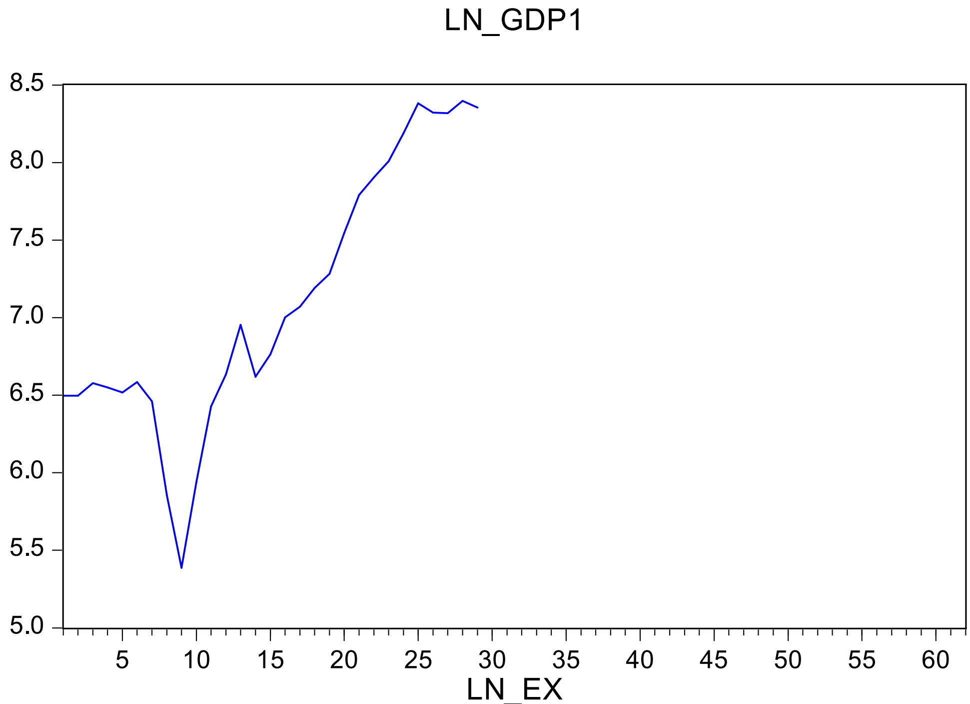
LN_EX

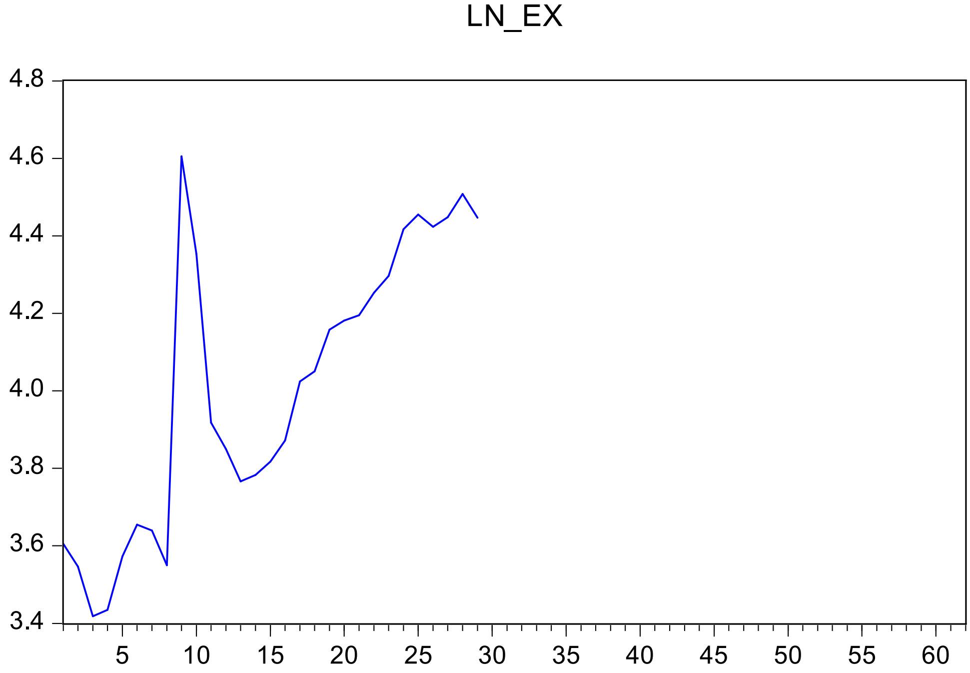


Appendix A.2: Albania Non-stationary variables

LN_EF




LN_GDP1
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
5 10 15 20 25 30 35 40 45 50 55 60


LN_EX
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
5 10 15 20 25 30 35 40 45 50 55 60

Appendix B: Results from unit root test (ADF)

	Sweden	Albania
EF	6.105 (19.652)	-1.4428
First Difference EF	-3.7505**	-4.5641***
Y	-2.5979	-2.6497
First Difference Y	-4.3216**	-3.6642***
Y^2	-2.5311	-2.4813
First Difference Y^2	-4.3863***	-3.6482***
EX	-2.4452	-3.3153
First Difference EX	-4.2125***	-5.6048***

** p<0.05, ***p<0.01 (ADF tau test)

Appendix C.1: Lag order selection criteria Albania

VAR Lag Order Selection Criteria
Endogenous variables: LN_EF LN_GDP1 LN_GDP2 LN_EX
Exogenous variables: C
Date: 03/16/17 Time: 10:10
Sample: 1 62
Included observations: 25

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-39.54727	NA	0.000383	3.483782	3.678802	3.537872
1	58.14028	156.3001	5.68e-07	-3.051222	-2.076122	-2.780771
2	94.51877	46.56447*	1.25e-07	-4.681502	-2.926320	-4.194689
3	112.1741	16.94915	1.50e-07	-4.813931	-2.278669	-4.110757
4	150.3660	24.44281	5.33e-08*	-6.589282*	-3.273940*	-5.669747*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix C.2: Lag order selection criteria Sweden

VAR Lag Order Selection Criteria
Endogenous variables: LN_EF LN_GDP1 LN_GDP2 LN_EX
Exogenous variables: C
Date: 03/16/17 Time: 09:56
Sample: 1 62
Included observations: 25

Lag	LogL	LR	FPE	AIC	SC	HQ
0	75.52939	NA	3.85e-08	-5.722352	-5.527331	-5.668261
1	139.0192	101.5836*	8.80e-10	-9.521532	-8.546431*	-9.251081
2	147.3011	10.60084	1.83e-09	-8.904085	-7.148903	-8.417272
3	170.1777	21.96158	1.45e-09	-9.454216	-6.918954	-8.751042
4	208.9984	24.84522	4.89e-10*	-11.27987*	-7.964526	-10.36033*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix D.1: bound test for Albania

ARDL Bounds Test
Date: 03/16/17 Time: 12:13
Sample: 1988 2012
Included observations: 25
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	9.701989	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Appendix D.2: Bound test Sweden

ARDL Bounds Test
Date: 03/16/17 Time: 09:51
Sample: 2 29
Included observations: 28
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	10.38341	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Appendix E.1: Long-run coefficients Sweden

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP1	1.716385	1.219105	1.407906	0.1731
LN_GDP2	-0.080993	0.059294	-1.365948	0.1858
LN_EX	0.247728	0.081277	3.047965	0.0059
C	-8.211070	6.387041	-1.285583	0.2120

Appendix E.2: Long-run coefficients Albania

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP1	13.197481	4.155426	3.175964	0.0192
LN_GDP2	-0.879831	0.288144	-3.053442	0.0224
LN_EX	0.827732	0.465918	1.776562	0.1260
C	-51.436918	16.471147	-3.122850	0.0205

Appendix F.1: Granger causality test Sweden

Pairwise Granger Causality Tests
Date: 03/16/17 Time: 09:52
Sample: 1 62
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LN_GDP1 does not Granger Cause LN_EF	28	3.10819	0.0901
LN_EF does not Granger Cause LN_GDP1		2.30257	0.1417
LN_GDP2 does not Granger Cause LN_EF	28	3.09107	0.0910
LN_EF does not Granger Cause LN_GDP2		2.22436	0.1484
LN_EX does not Granger Cause LN_EF	28	8.79493	0.0066
LN_EF does not Granger Cause LN_EX		0.01421	0.9061
LN_GDP2 does not Granger Cause LN_GDP1	28	0.30026	0.5886
LN_GDP1 does not Granger Cause LN_GDP2		0.24782	0.6230
LN_EX does not Granger Cause LN_GDP1	28	2.65701	0.1156
LN_GDP1 does not Granger Cause LN_EX		2.36417	0.1367
LN_EX does not Granger Cause LN_GDP2	28	2.59394	0.1198
LN_GDP2 does not Granger Cause LN_EX		2.25617	0.1456

Appendix F:2: Granger causality test Albania

Pairwise Granger Causality Tests
Date: 03/16/17 Time: 12:21
Sample: 1984 2012
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
LN_GDP1 does not Granger Cause LN_EF	25	2.43857	0.0894
LN_EF does not Granger Cause LN_GDP1		0.71767	0.5921
LN_GDP2 does not Granger Cause LN_EF	25	2.18921	0.1166
LN_EF does not Granger Cause LN_GDP2		0.81396	0.5346
LN_EX does not Granger Cause LN_EF	25	3.23886	0.0398
LN_EF does not Granger Cause LN_EX		0.89876	0.4876
LN_GDP2 does not Granger Cause LN_GDP1	25	0.36765	0.8281
LN_GDP1 does not Granger Cause LN_GDP2		0.31595	0.8631
LN_EX does not Granger Cause LN_GDP1	25	3.55856	0.0293
LN_GDP1 does not Granger Cause LN_EX		4.05108	0.0187
LN_EX does not Granger Cause LN_GDP2	25	2.89203	0.0561
LN_GDP2 does not Granger Cause LN_EX		3.20402	0.0412

Appendix G.1: Sweden Serial correlation

VAR Residual Serial Correlation LM ...
Null Hypothesis: no serial correlation...
Date: 03/16/17 Time: 12:19
Sample: 1984 2012
Included observations: 27

Lags	LM-Stat	Prob
1	16.71889	0.4040
2	33.70773	0.0059
3	5.919877	0.9889
4	36.24145	0.0027

Probs from chi-square with 16 df.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.534296	Prob. F(1,21)	0.2291
Obs*R-squared	1.906440	Prob. Chi-Square(1)	0.1674

Appendix G.2: Albania serial correlation

VAR Residual Serial Correlation LM ...
Null Hypothesis: no serial correlation...
Date: 03/16/17 Time: 11:25
Sample: 1984 2012
Included observations: 27

Lags	LM-Stat	Prob
1	17.24256	0.3701
2	21.30879	0.1669
3	14.41288	0.5680
4	18.43568	0.2990

Probs from chi-square with 16 df.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.424347	Prob. F(2,4)	0.6806
Obs*R-squared	4.375887	Prob. Chi-Square(2)	0.1121

Appendix H.1: Sweden heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

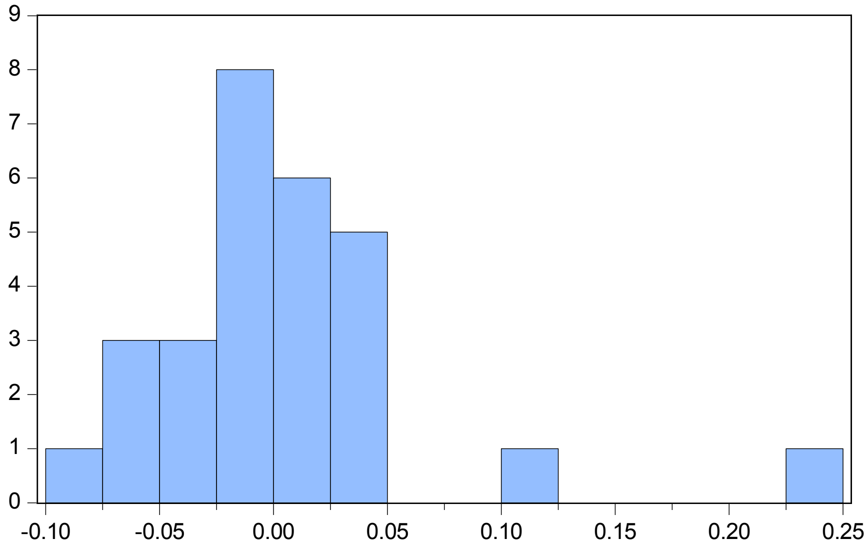
F-statistic	0.228478	Prob. F(5,22)	0.9461
Obs*R-squared	1.382176	Prob. Chi-Square(5)	0.9263
Scaled explained SS	3.623525	Prob. Chi-Square(5)	0.6048

Appendix H.2: Albania heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.392273	Prob. F(8,18)	0.2650
Obs*R-squared	10.32085	Prob. Chi-Square(8)	0.2432
Scaled explained SS	3.954923	Prob. Chi-Square(8)	0.8612

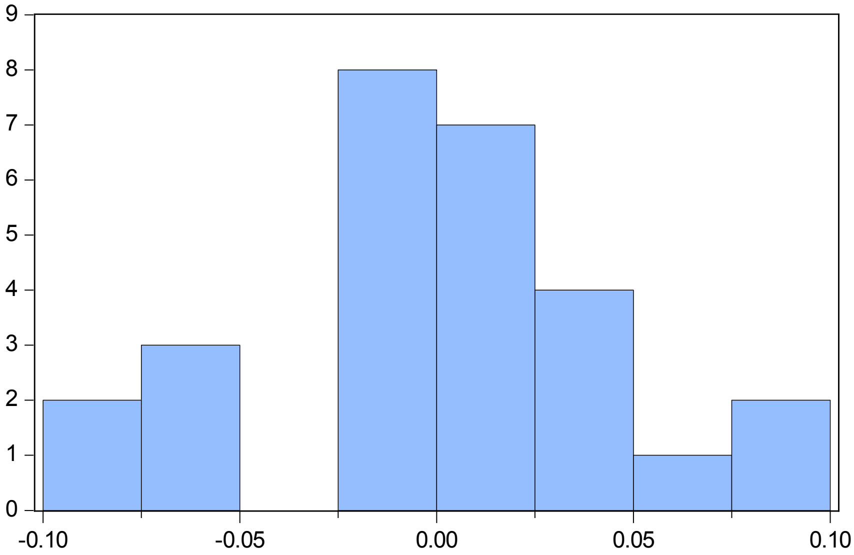
Appendix I.1: Sweden Normality



Series: Residuals
Sample 2 29
Observations 28

Mean	1.65e-15
Median	-0.010115
Maximum	0.232338
Minimum	-0.075137
Std. Dev.	0.059704
Skewness	2.120456
Kurtosis	9.493146
Jarque-Bera	70.17068
Probability	0.000000

Appendix I.2: Albania normality



Series: Residuals
Sample 1986 2012
Observations 27

Mean	-9.33e-16
Median	0.000669
Maximum	0.092072
Minimum	-0.082401
Std. Dev.	0.044890
Skewness	0.016800
Kurtosis	2.724388
Jarque-Bera	0.086728
Probability	0.957563

Appendix J.1: Sweden model selection summary

Model Selection Criteria Table
Dependent Variable: LN_EF
Date: 03/16/17 Time: 10:02
Sample: 1 62
Included observations: 28

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
6	39.693028	-2.406645	-2.121172	-2.319373	0.436406	ARDL(1, 0, 1, 0)
4	39.641518	-2.402966	-2.117493	-2.315694	0.434328	ARDL(1, 1, 0, 0)
5	39.960195	-2.354300	-2.021248	-2.252483	0.420729	ARDL(1, 0, 1, 1)
3	39.953411	-2.353815	-2.020764	-2.251998	0.420448	ARDL(1, 1, 0, 1)
2	39.784302	-2.341736	-2.008685	-2.239919	0.413405	ARDL(1, 1, 1, 0)
1	39.960488	-2.282892	-1.902262	-2.166530	0.391778	ARDL(1, 1, 1, 1)
8	35.523843	-2.180275	-1.942381	-2.107548	0.273905	ARDL(1, 0, 0, 0)
7	35.527513	-2.109108	-1.823636	-2.021836	0.241099	ARDL(1, 0, 0, 1)

Appendix J.2: Albania selection summary